January 1992 Issue #6

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

A Mickey Mouse Operation

Mickey Mouse spoke with fans from all around the world during the Disneyland Amateur Radio Club's international special event station commemorating Walt Disney World's 20th Anniversary last September. Joining Disneyland were sister stations at Walt Disney World in Florida, Tokyo Disneyland, and the Queen Mary & Spruce Goose Entertainment Center in Long Beach, California. Combined, the four stations made about 6,000 contacts with hams worldwide. About half were made by Disneyland operators, who reached hams in far-flung locales such as Spain, Tahiti, New Zealand, Hawaii, and Japan. Pictured with Mickey are DLARC members (clockwise from upper left) Russ Petersen of Disneyland Security, Gardner Harris, Paul Caraso, and Theodore Fukushima. The latter three "associate members" are not Disneyland employees.

More Hams in Space

Lou McFadin W5DID, SAREX expert for NASA at JSC, says that STS-45 should launch about March 10, and will carry the Motorola HT used in earlier flights. STS-45, however, will have only FM voice capability. Space and power restraints aboard the orbiter have kept the SAREX equipment down to a minimum, and the HT will run on its own batteries. If the batteries are charged at the last possible moment, current estimates are that they will have about three hours of operation per day available during the flight. Actual on-the-air time will depend on astronaut time available and the flight schedule. Some school schedules will be set up as in past missions. Frequencies are expected to be similar to earlier flights, and will be announced soon.

STS-45 will fly a high inclination orbit (57 degrees instead of the usual 28.5 degrees) at an altitude of 160 miles, and pass over most of the populated areas of the world, giving good coverage to hams on all continents. Brian Duffy N5WQW will pilot the *Atlantis*, and David Leestma N5WQC will be a mission specialist on the seven-crew, eight-day mission.

Also on the mission will be Dr. Dirk Frimout ON1AFD. There are only three hams living in the town where Dr. Frimout was born in Belgium. Everyone is looking forward to having a chat with him in the sky!

The mission's prime objective will be to use the Atmospheric Lab for Applications and Science that will be carried in an igloo in the payload bay. TNX *OSCAR Satellite Report, Nos. 232, 233,* and *Westlink Report, Nos. 610 and 612.*

New Japanese Calls

Japanese callsigns usually begin with "J," but as of April last year, all such signs allocated to the Kanto area (around Tokyo) were used up, and as an exception, new calls beginning with "7" (7K1 to 7N1) were introduced.

By August 1991, the allocation of "7N1" prefixes was full. To cope with the situation, on July 23 the callsign designation standard for identification of amateur radio stations was partially amended, and the new prefixes of "7K2" to "7N4" were allocated to the Kanto area.

The number of amateur radio stations in Japan came to 1,101,431 last spring. The Japan Amateur Radio League, Inc., held the largest and most popular hamfest last August, the '91 Amateur Radio Festival (Ham Fair '91) at the New Hall of Tokyo International Trade Center Harumi. The Fair recorded a total of 60,000 visitors, far exceeding last year's figure. TNX *The JARL News, Vol. 4, Nos. 8, 9.*

The Powder Spring Georgia Wolf Pack 405 at the 1991 Boy Scout Jamboree. The Wolf Pack talked with local hams on 2 meters in Conyers, Georgia, were the Jamboree was held. They were also able to talk with other scouts and hams across the country. N4MNA Willie Jeter (left; callsign on cap) and Robert Jones AB4HJ (taking the photo) of the Metro Atlanta Amateur Radio Society helped with the event. TNX Robert Jones.

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YAESU	ICOM
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ICOM: U16, H16, V100, U400
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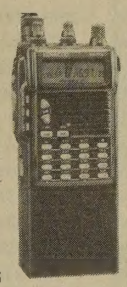
MARINE ICOM: M7, M56, M700
AVIATION ICOM: A20 H.T., TAD

IC-W2A

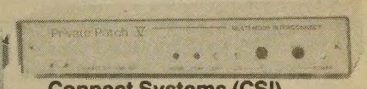
IC-H16/U16

MOTOROLA RADIUS COMMERCIAL RADIOS



TH-77A

FT-470



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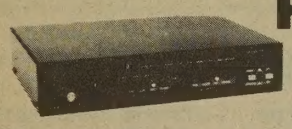
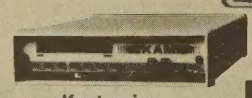


Panasonic
Shortwave Radios/Marine



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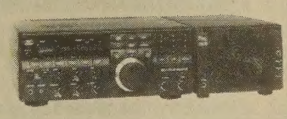

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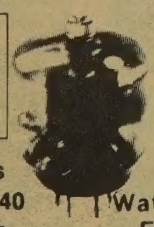

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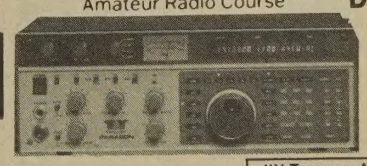

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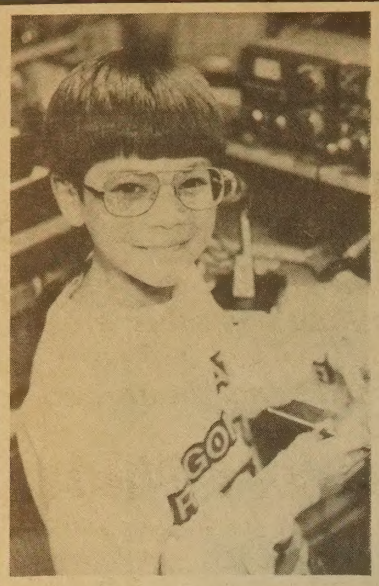
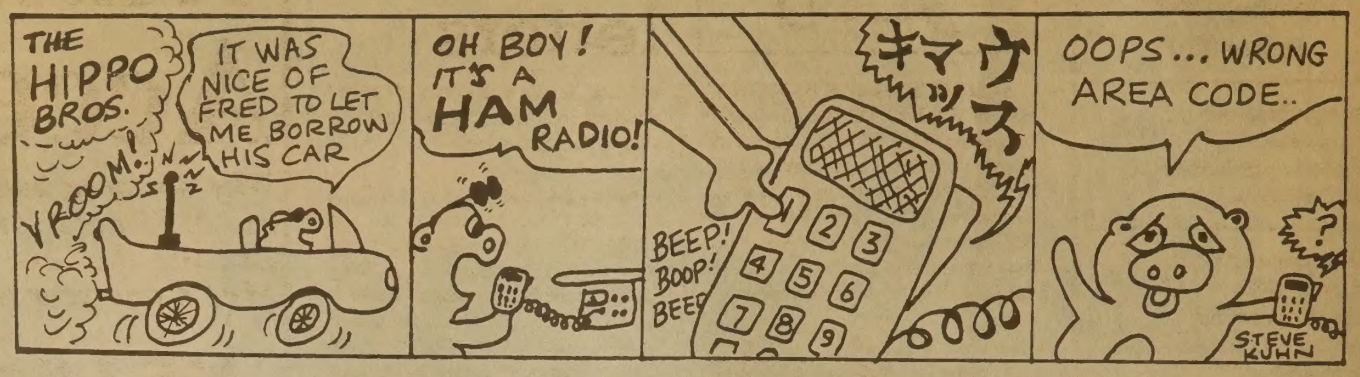


Steve's Hippo Brothers



Nine-year-old Steve Kuhn has been drawing and cartooning for several years, along with playing the drums and keyboard. His dad, Bob Kuhn KC7YN, publishes his cartoons in *The MARC Wireless*, the newsletter of the McMinnville Amateur Radio Club. Besides bringing a healthy chuckle to readers, the Hippo Brothers give the newsletter an original look. Steve knows some CW, and sometimes he talks on his dad's QSOs on SSB. Who knows, Steve might also become a licensed ham some day. Keep the Hippo Bros. hamming, Steve!

DOVE "Speech Therapist"

Bob McGwier N4HY, the AMSAT satellite "speech therapist," has been making steady progress on the software which will enable DO-17 to speak. For a few weeks last September, he and his wife Shann N2HPE were able to upload code that incorporated whole orbit data (WOD) routine which will allow the first really good look at DOVE's health. The WOD collection function can gather up to about five orbits of data at a time, then download them all. A new software upload is being prepared to perform tests on DOVE hardware interfaces in the voice module.

Jim White WDØE is leading a team of DOVE telemetry watchers to provide Bob with as much feedback as possible while he tests new sections of the code. Jim has recently automated his station to collect WOD dumps. The WOD is in the same binary format as used previously by the other three Microsats, and is still in use on WO-18. Analysis of the first set of WOD indicates that the bird is in very good health. The transmitter power is currently being run at a whopping 3.6 watts for about 95% of each orbit, dropping to about 2.4 watts at the tail end of eclipse. This will be adjusted as the command team gains experience with this mode of operation and begins to exercise other spacecraft functions.

Jim has uploaded to Lib5 of CompuServe's HAMNET forum a text file of one orbit DOVE WOD taken this past week. This is the first WOD we have had from DOVE. It is a ZIPed text file that he wrote out of Excel on the Mac, and is the one he created graphs from that were looked at to analyze the functions of the power control systems in the spacecraft. There will be further WOD gathered as time allows between voice development, and he will attempt to upload those files also. TNX *Westlink Report, No. 609.*

Marine Corps Marathon

More than 85 amateur radio operators cooperated with Marine Corps and other military personnel to manage communication and logistics at the 16th annual Marine Corps Marathon last November 3 in Washington, D.C. The event has been sponsored by the U.S. Marine Corps since 1975. The hams were members of the Pentagon Amateur Radio Club, the Vienna Wireless Society, the Mt. Vernon Amateur Radio Club, the Southern Maryland Amateur Radio Club, and other amateur radio organizations in Virginia and Maryland.

Volunteer hams monitored the health and safety of the 13,000 runners and hundreds of thousands of spectators as the race progressed through Virginia and the streets of Washington, D.C. They also coordinated medical assistance for the runners from a base station at the finish line near the Iwo Jima monument in Arlington. Additional hams with hand-held transceivers were stationed at each of the nine aid stations along the 26-mile course.

"Our chief responsibility was to ensure the safety of runners and spectators at all times," said Maj. Dick Lum, USAF, volunteer coordinator of amateur radio activities for the event. "Luckily, only a few runners required significant medical assistance on the course this year, and hams were there to help the Marines make sure they got it quickly. We think our ability to staff this complex event complements the Marine Corps' exceptional logistics ability very well."

Lum said that hams also monitored the race with an amateur television system along the course, as well as through a packet radio network which linked ham radio to personal computers at area hospitals, including George Washington University Hospital, National Orthopedic Hospital, and Arlington Country Hospital. Hams also used their equipment to facilitate communication between the various military, police, and emergency services among five federal, state, and county jurisdictions.

Amateur radio clubs coordinate communications for hundreds of special events every year, ranging from marathons to bicycle races and polar expeditions.

Rotuma DXpedition Report

From Antoine D.R. N'Yeurt 3D2AG, thanks to KD0JL: Rotuma Island is a small, isolated volcanic island located 12.30S and 177E, occupying about 17 square miles and having a population of about 3,000. It is under the administration of the Fiji government.

Since becoming a new DXCC country a couple of years ago, a number of expeditions have been there, including the 3D2XX team and Bing Crosby VK2BCH.

As there are no hotels or such facilities on the island, one has to rely on the hospitality of the people. Money has little meaning on the island, hence one has to be considerate of local customs. Also, there is no regular power, and the only links with the outside world are twice-monthly boat visits from Fiji, and a weekly flight from Nausori.

My own plans for a DXpedition to Rotuma materialized in late June 1991, when I got a one-month leave from my university duties. Knowing a family on the island, accommodation was not a problem. Hence I packed up all my ham gear, including two solar panels for charging a 12V car battery. Bing VK2BCH kindly offered the use of his generator and battery on the island, as well as his beam. With eagerness, I boarded the MV Wairua for the two-day trip to the paradise of Rotuma Island.

While the boat journey was by no means easy (especially on one's stomach!), the scenery was beautiful, and the cheerfulness of my fellow passengers was extraordinary. On Monday morning about noon we reached the Island, and the wharf at Oinafa was bustling with people and vehicles (about six of them—the entire contingent of the island). After a day with my friendly hosts and a look at the marvelous white beaches at Oinafa, we set out by truck to Fapufa, the village where the beam and radio shack of 3D2XX fame is located.

Fapufa is located on the southwest corner of the island, and consists of three houses. The area is noted for its beautiful scenic beach and an underground freshwater cave which is also a favorite swimming spot.

The "shack" actually consisted of a palm-frond hut with provisions for an operating table and bed. The beam was about five meters from the hut, and had to be turned arm-strong. For ground connections, I opted to throw an old bicycle frame into the adjacent lagoon. The 40/80 meters antenna was a dipole, swung between two coconut trees at about 66 feet. The setup worked very well, especially on 40 meters.

As far as the power situation went, I opted to connect the two 12V solar panels to a car battery for daylight operation. At night, a 240V generator was used.

My operations were mostly nocturnal, owning to the poor propagation during the day. Ten meters was dead most of the time, although quite a few JAs were worked in the mornings on 14 and 28. Fifteen meters was open to the states from 0000 to 0400 UTC, and I occasionally checked in to the ANZA net and the 14222 net. The real action, though, did not begin until about 1030Z, when the 20 meter band was opening to the states. Large pile-ups were worked well into the early hours of the morning, including QSYs to 40 and 30 meters. The daily number of QSOs could average 300, mostly CW.

At times, the generator would run out of fuel in the middle of a pile-up, and one had to switch to battery power. One night was really bad; I had to write my log using a torchlight in one hand and mike in the other. However, these are the inevitable trials of a DXpedition.

Propagation conditions were not too good on the first few days, but we made about 300 QSOs daily, mainly CW on 14 and 7 MHz. Owing to the difficulty of turning the beam, not too many Europeans were worked, but we did get through to most parts of the world.

As far as living conditions went, the shack sported a wooden bed plus mosquito net, which was very useful. At night all sorts of bugs and rats prowled the hut, and it could get quite scary.

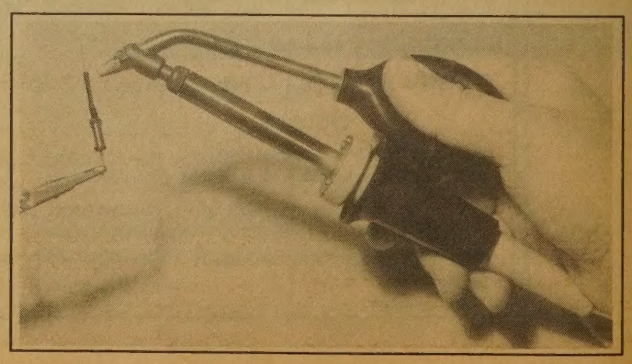
Overall, the expedition was a success, and we hope that many operators were happy to get a "new one" as a result. *VY 73, Antoine 3D2AG.*

The *Right* Way to Shrink Heat-Shrink Tubing

Heat-shrink plastic tubing is great for insulating almost anything. Just slip it over a connection, heat it, and it shrinks to less than half its original diameter, forming a tight grip.

The problem is *how* to shrink it. Professional labs use expensive hot-air guns. Most hams use matches—which tend to melt or burn the tubing as it shrinks.

The *right* tool, as shown in the picture, is a desoldering iron. Let it get good and hot and then squeeze the bulb to send a puff of hot air onto the tubing. The air flows around the tubing and heats it much more evenly than a match would. Proper shrinking will probably require four or five leisurely puffs.



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letters

Scott R. Becker KB5MOH/Ø, Kiowa KS BRAVO! on *Radio Fun* magazine. Just what the doctor ordered! Here is my subscription order that I'm taking out for my dad for Christmas. What a gift! But now the BIG question: How do I keep him away from the bratwurst and the sauerkraut long 'nuff for him to read the thing?

Michael J. Pittman KC6GAR, Tacoma WA *Radio Fun* fills a much needed gap in amateur radio. Perhaps in the last 10 or 20 years the beginner's market dried up, but it seems to me that amateur radio is starting to come back to life. Now, if we can just get past the inane "5-9, weather is cold and rainy. I'm using a Bentwood model XP 2000 running a full megawatt into a 102-element yagi 650 feet above my apartment" syndrome!

Roberta Perkins, Wilmington DE Received my copy of the Premier issue of *Radio Fun*, and I am looking forward to the subsequent issues. I am very delighted to read that there is going to be plenty of information on QRP—activities, projects, and kits. The reviews on QRP kits, equipment, and antennas are a pleasure to see! I am more interested in having fun and seeing if I can develop operating skills at low power than in blasting the air waves. I have operated QRP almost exclusively since I was licensed about eight years ago. My most enjoyable contacts have been with CW. Please keep these activities as viable components of this magazine.

I have done little building and reading of theory, so this magazine is right on time for me. I was preparing to purchase a transceiver kit that would cost much more than the transmitter and receiver kits in the Premier issue. Seeing the reviews changed my mind. I am certainly looking forward to having fun and learning from this magazine.

Gene KD4CNO Thank you for publishing the most enjoyable ham magazine ever. Your articles are always interesting and applicable to my interests. Thanks to your encouragement, I have upgraded from Novice to General, having been licensed for only about three months.

What a delight it is to be an amateur in 1991! Today's ham can enjoy the excitement of amateur radio in ways our forebears doubtless never dreamed. I refer not to packet, ATV, moonbounce, OSCAR, etc., but to the code vs. no code debate! The earnestness with which amateurs defend either position would bring a tear of joy to the eye of any trial attorney. I hope that this issue does, in fact, remain within the realm of enjoyment since this is what our hobby is all about. To this end, I will now offer some new ammunition to my fellow members of the Dusty Mic Club: As I understand, about *twenty* A1A signals will fit in the same amount of spectrum occupied by *one* J3E emission; perhaps as our bands become more overcrowded, the FCC will change the rules again—this time from "no code" to "no voice" allowed! Please address subsequent issues of *RF* magazine and all hate mail in care of General Devlivery, F2 layer. Thanks again for a really fun magazine.

Aaron Jackson Most kids will listen to their favorite radio station and think, "Who cares, it's just a stupid radio station that plays music. Why should I care how it works or why it works?" Well, that was the way I thought about HAM radio before Mr. Jost, my teacher, took me into his classroom to show me the equipment that the school had for young people who are interested in ham radio. Suddenly, this whole new world opened up to me. A world that I found intriguing. A world that needed exploration. When I did, I found I couldn't stay away from the world of ham radio!

My first contact was a man named Charlie HC1EEV in Ecuador. I was real nervous and I just couldn't talk right. Now, my contacts and Mr. Jost say I'm a polished operator, even though I don't have my license. The reason I can operate the school's FT-757 CX II is that Mr. Jost is my "control operator" (NØJRS). He helps kids here in Sterling, Colorado, learn more about ham radio.

There is a poster on the wall that lists the names of those kids who have received their ticket. My friends, Ryan Clark, Pete Hildago, Jason Foos, and Brian Kaiser (who has already passed his written exam), and I, also want to be added to the great number of people on that list.

The school station here in Sterling is on the air Tuesdays and Thursdays, on the 10 meter band, USB, from approximately 3 p.m. until 4:30 p.m., mountain time. If anyone wants to look for us, we're having a contest to see which class can receive a contact from each state. (DX contacts are worth two points, and each contact within the states are worth one point each.) The first class to get 50 points wins.

Dino Economos KB5OYJ, Tulsa OK Just after Bill Walker WØKNR introduced me and a friend to amateur radio in the form of listening to AM QSOs from around the world, his instruction was to simply to call on him again when we had learned the Morse code.

It never occurred to us that we wouldn't. Mr. Walker said we should, and so we did. These days the instructors are apologetic about it as though it's going to be some chore. It was no chore for us because 12-year-olds didn't usually have their own telephones in 1958, and a wire between houses with a key at each end actually seemed imperative. I suppose kids today would go right to the repeater.

At first Joe and I copied the dots and dashes on paper. Neither one of us was trying to learn the code. We were only trying to decipher the important messages we had for one another. (Start publishing lottery numbers in Morse code, and see how many new operators you get!!!)

I suppose there came a time when we started recognizing the code without looking up the letters. I really don't remember. All I do remember is that

Continued on page 13

CMOS IC Keyer

Build this versatile station accessory using common parts.

by Gerald F. Gronson K8MKB

I'm getting tired of hearing hams complain about how nobody builds anymore because parts are so hard to find—you have to order them from a mail order house, and wait. Yaah. Fooey!

Well, guess what! A number of parts are available from Radio Shack.

If you've never built an electronic gadget, it's a good idea to learn how to solder first. [*See the article on page 7 of the December 1991 issue.*] Now this might just be the ticket to get you interested in a whole new aspect, almost lost, of our hobby. In many respects it's easier than ever to build equipment. What with ICs, perfboard, CMOS, VMOS, etc., all you need to begin are model hobby tools. In the old days you had to be a qualified sheet metal worker, as well as an electronics genius, to work on a project.

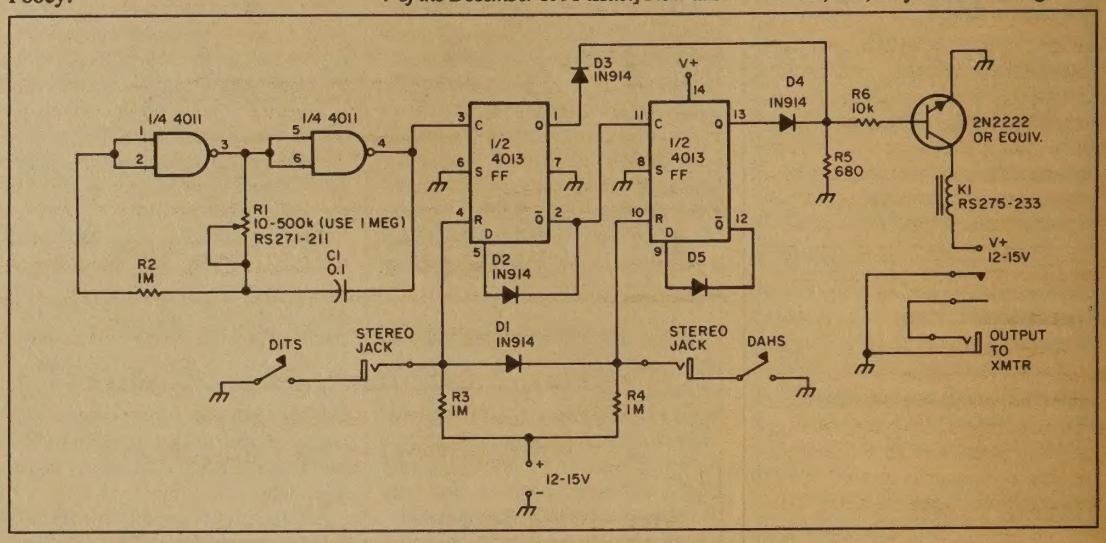


Figure 1. Schematic for the CMOS IC Keyer.

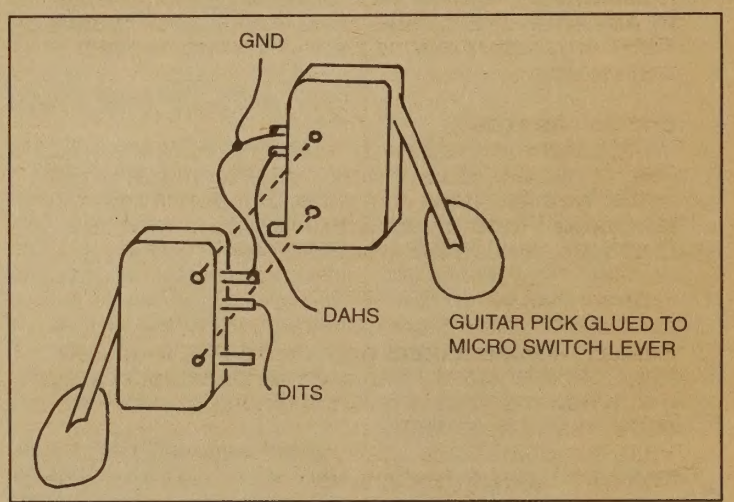


Figure 2. Stack the two microswitches on top of each other and run wires to the appropriate locations on the PC board. Guitar picks can be glued to the microswitch levers to make a keyer paddle.

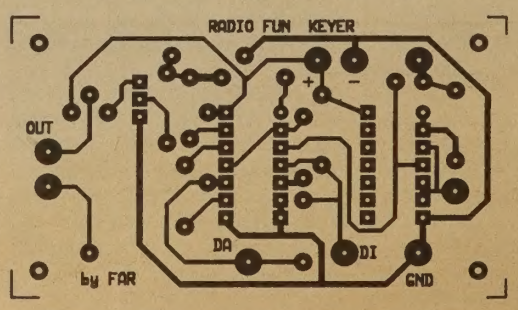


Figure 3. PC board foil pattern for the keyer.

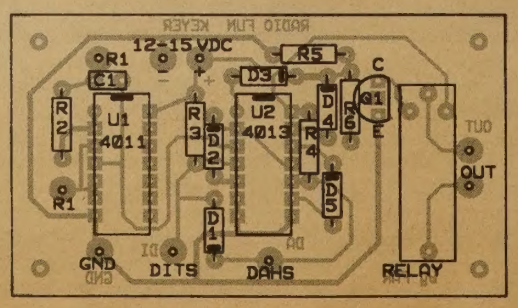


Figure 4. Parts placement.

Easy to Build Keyer

This circuit is for a CMOS IC keyer. CMOS means "complementary metal-oxide semiconductor." The CMOS "logic family" is characterized by very low power dissipation, low circuit density per chip, and higher speed of operation compared to other IC logic families.

All the parts are available from Radio Shack. The circuit is described in *NEW IC FET Principles and Projects*, by Tab Books, printed in 1972. Since '72, better and cheaper ICs have become available. Also, you can use a general purpose circuit board, or you can use the PC board shown in Figures 2 and 3.

The heart of the keyer is a straightforward clock oscillator. The speed of the oscillator is made variable by R1 (resistor 1). The code speed can be

parts list for CMOS keyer

Part	Description	RS Cat.#
U1	Quad 2-Input NAND Gate, 4011	276-2411
U2	Dual type-D Flip Flop, 4013	276-2413
Q1	Transistor, MPS2222A	276-2009
K1	Relay SPST, 1-amp cont.	275-233
D1,2,3,4,5	Diodes, 1N914	276-1122
R2,3,4	Resistors, 1 Megohm 1/4W	271-1356
R1	Potentiometer, 1 Megohm	271-211
R5	Resistor, 680 ohms, 1/4W	271-021
R6	Resistor, 10K ohms, 1/4W	271-1335
C1	Capacitor, 0.1 µF	272-1070
2	IC-sockets, 14-pin	276-1999
1	Stereo Jack, 1/4" open CKT	274-312
1	Mono Jack, 1/4" open CKT	274-252
1	Universal Board	276-168

Misc.: 12 VDC Power supply, case and speed control knob.
Note: A blank PC board is available for $4 + $1.50 postage/handling per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

calculated by the formula:
Cs (words/min.) = 1.2 x clock frequency

The device makes well-formed characters that are self-completing. This means that if you let up too soon on the "dah" side of the paddle, it will form a full "dah" (dash).

Good Power Supply Necessary

I strongly recommend that you have a well-regulated, power supply for your keyer. You can use your 12 VDC station power supply, a battery or build your own supply. Power supplies are also available from Radio Shack, as are parts to build a good, usable power supply.

Construction Steps

Use sockets for the ICs. First solder the IC sockets in place and then solder in the resistors, diodes and the capacitor. Finally, install the transistor and the relay. I wired up a stereo phone jack for the keyer paddle input and a regular phone jack for the output to the transmitter. You should mount potentiometer R1 to the front panel of your case or enclosure so that you have an easy way to adjust the code speed.

Operation

This circuit is designed to go between a keyer paddle and your transmitter (just plug the output of the keyer into your rig's KEY input). A keyer paddle is essentially a mechanical device with two switch contacts. Usually pushing the left paddle closes the "dot" switch contact, and pushing the right paddle closes the "dash" switch. Depending on which switch is closed, our circuit will generate a series of dots or dashes until the paddle is released. While pressing on either the dot or dash paddle, just adjust potentiometer R1 until you are sending CW at a comfortable speed.

If you'd like to make your own keyer paddle, just mount two Radio Shack micro switches (RS# 275-016) back-to-back on a piece of wood. The left switch will be your "dash" switch and the the right switch will be your "do" switch. You could even mount these micro switches right on top of your keyer case to give you a very compact and portable keyer.

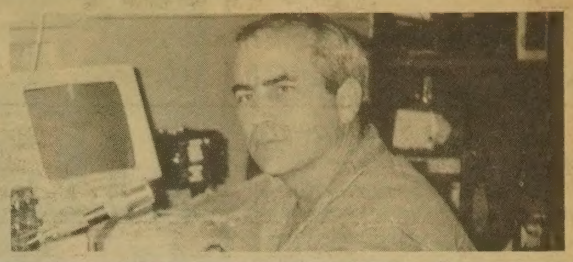
I hope you find this project useful as well as enjoyable. 73 es QRT. de K8MKB. RF

Gerald F. Gronson K8MKB, 3529 Belinda Drive, Sterling Heights MI 48310.

Photo G. Marcell Richer 3XØHNU (ex F6EKD, FR7BB, FY7BW, FKØBA, TL8RM, and TL8A) reports the call is worth 10 dBi. QSL via F6FNU.

Photo H. Joe OE6PDJ is active on 10 and 15 meters. TNX KDØJL.

Photo F. Jose CT3FF operated XX3JP special event station for the visit of Pope John Paul II to Madeira Island last May 1991. TNX KDØJL.



Advice from Sammy AAØCR

Sammy Garrett, 1991 Young Ham of the Year, writes a column in the *Westlink Report*. In the October column, he offers young people some ideas on "Getting Over the Fear of Talking to Adults." Here are some excerpts:

"One of the big reasons I think some young hams don't get on the air very much is because they are afraid of, or are self-conscious about, talking to adults. Many kids are used to having adults talk *at* them rather than *to* them." Sammy reveals a common complaint among young people: "Instead of talking to young hams about their latest antenna project, some adults tend to ramble on about what they did when they were our age. But most of the time we kids would like them to consider what *our* interests might be. We can talk about a lot of things. Besides, we can't learn about the hobby if we can't talk about the things happening in it now."

Sammy advises patience on both sides: "Even though some adults might seem uncomfortable talking to you, they are interested in bringing more young people into the hobby. Most adults are willing to help young hams in any way they can. . . . be patient with adults and try to help them understand that you are a person, too, not just a kid. If you find yourself a little shy or are unsure of yourself when talking to adults, just remember that they are there to help you. If you make a mistake, don't worry. You won't be laughed at or criticized by them. They are interested in guiding you because they know you are the future of amateur radio. And adults, please remember to be patient with us as we learn!"

Watt Is Electricity?

Electricity is a colorless, odorless gas which burns with a bright flame.

Light grows from a bulb.

An amp is a little animal that crawls along a wire.

An amp lives in an ohm.

In summer, an amp lives in a coulomb.

Polarization is the changing of an ohm into a coulomb.

An ammeter is an animal that eats amps.

A battery fires amps around a circuit.

An amp rides around a circuit on a megacycle.

Megacycles are parked on a grid.

Flemming's right-hand rule states that: All amps must ride their megacycles on the right-hand side of the wire.

A charge occurs when all the amps ride down the circuit at the same time.

All amps meet at an accumulator.

An oerstead is an ohmstead for orses.

A joule is a fight between two amps.

You receive a shock when an amp isn't wearing any shoes.

And you must watch out that the amp isn't riding a kilocycle, because then it hertz.

From the Australian publication, Amateur Radio, *the September 1991 issue, Gilbert Griffith VK3CQ's column, "Pounding Brass."*

vintage RF review

The Kenwood TS-130S

A good rig done better.

by Paul Grupp KA1LR

Kenwood no longer makes the TS-130S, but watch for this excellent radio at hamfests, swap nets or in used equipment ads.

When Kenwood introduced the TS-120S some time ago, it was an instant success. There weren't many rigs like it available at the time and Kenwood's engineers managed to cram an incredible number of useful features into a very small box.

After WARC, Kenwood decided to upgrade their HF transceivers to include the new amateur frequency allocations, and the TS-130S was one of the first of the improved rigs to appear on the dealers' shelves. Not content to merely add a few new positions to the bandswitch, Kenwood listened carefully to TS-120S owners and included some useful new features in the package. For example, when mobiling an HF rig, every watt of transmit power counts, and the lamentable omission of a speech processor from the 120S has been corrected in the 130S. Many CW operators like to be able to choose between wide and narrow CW filtering, depending on band conditions. With the 120S, once the narrow filter is installed, it is automatically selected whenever the mode switch is in the CW position. CW operators have been placated by the addition of a wide/narrow filter switch on the front panel of the 130S. Small changes? Maybe, but they can make a big difference if they happen to be important to you!

After owning an ICOM IC-701 for over a year and using a Yaesu FT-707 for the last several months, I thought I would round out my experience with small HF rigs and get a Kenwood TS-130S. Here is what I discovered.

The Features

When you sit down in front of a 130S for the first time, it doesn't take long to discover that while it is small, it *is* a complete rig. In fact, it incorporates almost all the features of much larger transceivers like the TS-820S. Here are a few of the facilities available to the operator of the 130S: full filtering available for both CW and SSB, IF shift, RIT, speech processor, complete VOX facilities, built-in relay for linear amplifier switching, digital and analog readout, 25 kHz calibrator, noise blanker, and 80–10 meter coverage, including the new WARC bands. Not bad for a rig of any size!

The good stuff isn't inside the rig. There is an extensive line of matching accessories for the 130S, including several different types of remote VFOs, an external speaker for hi-fi audio fanatics, several microphones, an antenna tuner, a mobile mounting bracket, a monitor scope, and a phone patch. Kenwood has understood for years that hams like to have a lot of accessories to choose from for their stations (are you listening, ICOM?) and they are doing their best to provide them.

When the 130S arrived, it saw a couple of months' service in the *73* ham shack, where it performed well. Its microphone, remote VFO, and linear amplifier connectors are compatible with those on the TS-830S, allowing fast changeover for both rigs. In side-by-side comparison with the 830S, the 130S fared remarkably well. Any differences in sensitivity were deemed inconsequential, but the 830S was a slightly better performer in the selectivity department. Our admittedly subjective tests indicated that when both rigs were tuned to the same frequency, under certain conditions adjacent frequency "garbage" caused slightly more interference to the 130S than it did to the 830S. Otherwise, the 130S kept right up with its bigger brother. The IF shift is several orders of magnitude more useful than similar controls on some other transceivers. It really works! The internal speaker provides better than average audio quality, although it occasionally rattles when driven to the high levels favored by some staff members. When the rig is plugged into an external speaker, it provides typical Kenwood hi-fi audio at any practical level. The headphone jack on the front panel is wired to accommodate either mono or stereo headphones. Transmit audio was good with the three microphones we tried—a D-104, a Shure 444D, and a Yaesu hand microphone.

Kenwood deserves praise for the quality of the 130S instruction manual. Lots of practical information is provided on installation and use, for mobile as well as fixed operation. As is typical with Kenwood products, no service and alignment procedures are included in the instructions; you'll have to buy a separate service manual for that information. For emergency repairs by those hams brave enough to work on the 130S themselves, complete schematics and a block diagram are included with the rig.

The TS-130S.

On the Road

While the 130S is perfectly at home on the ham shack bench, it really comes into its own when installed in a vehicle. I operated it for several weeks from my car and grew very fond of it in that mode of operation. I sat it on the front seat beside me and ran the power lead directly to the battery. It draws too much current to use with my noise filter, and I was pleasantly surprised when I didn't hear the alternator whine that I hear with other rigs that aren't connected through the filter.

One feature that I found indispensable in mobile use was the speech processor—it can make a real difference on the other end of the QSO. With the processor on or off, adjusting the mike gain for the proper level using the ALC meter is a simple task. The ballistics of the meter allow sure and fast reading. The mike gain should be readjusted when the processor is turned on or off. The noise blanker did an excellent job of cleaning up ignition noise and I left it on all the time.

A characteristic that I found less than admirable was the limited bandspread of the main VFO knob. Tuning in a signal while bouncing down the road is a challenge—one flick of the knob and you've jumped 10 kHz! I eventually learned how to handle the knob with reasonable dexterity, but bandspread is an area in which the 130S could use improvement. Whatever one thinks of the bandspread, it is important to note that frequency stability is not a problem—the rig occasionally became airborne when my driving got, ah, shall we say, over-enthusiastic, but the frequency never drifted.

If the poor bandspread really gets to you, it might help to know that Kenwood offers a nice digital frequency controller that allows tuning of the rig from push-buttons on the microphone.

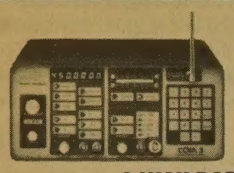
The real test of the transceiver came on the yearly pilgrimage to the Dayton Hamvention in the infamous *73 Magazine* S-100 van. We installed the 130S on a counter top in the back of the van, connected up a D-104 microphone, and used a Hustler mobile antenna to distribute the RF. The 130S did everything it was supposed to and more, shrugging off a couple of nasty spills onto the floor of the van, a fall of about three feet! A solar disturbance prohibited us from working any DX that weekend, but stations all over the United States were worked, mostly on 40 meters.

Conclusions

Considering the price and performance of the 130S, it represents an excellent buy for either fixed or mobile operation. It faces a lot of competition in the small transceiver market, but the current crop of rigs is so varied in concept that each has its own devoted following. If ease of operation, good audio, and a wide range of accessories strike your fancy, the TS-130S might be the rig for you! RF

Reprinted from the July 1981 issue of 73 Magazine.

RAMSEY ELECTRONICS



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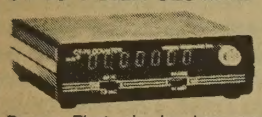
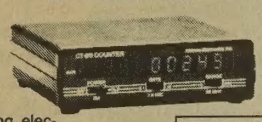
FREQUENCY COUNTERS

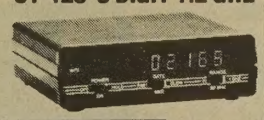
CT-70 7 DIGIT 525 MHz



CT-90 9 DIGIT 600 MHz



CT-125 9 DIGIT 1.2 GHz



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Low-pass probe, audio use, LP-1	$16.95
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Rechargeable internal battery pack, BP-4	$ 9.95
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ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	<25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	<50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	<50 mV	Convert your existing counter to 1.5 GHz		$89.95

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Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 . $12.95

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Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.
Complete kit, PC-1 .... $49.95

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Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 . $5.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

NEW SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.
SP-1 ..... $29.95 Case-CSP $12.95

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A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit $9.95

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Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug." Transmitter + receiver set, LB56 . $19.95

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Ramsey breaks the price barrier on 2 meter rigs! Here's the ideal rig for field days, hamfests, vacations, second cars and packet (it even has dedicated packet connections). Six expandable diode-programmed channels, 5W RF output, sensitive dual conversion receiver and EASY assembly. Why pay more for a secondhand old rig when you can make your own for less. Have some fun with your own truly AMERICAN-MADE FM rig! This kit comes complete except for the case, mike and speaker—ICOM or equal speaker-mikes plug right in. Add our own beautiful case set for a professional factory look.
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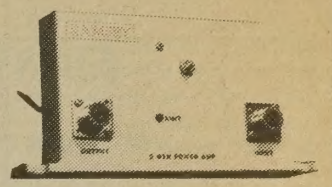
2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $79.95



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Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
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Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
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Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
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Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
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Shortwave converter kit, SCI $24.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
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Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

TERMS: Satisfaction guaranteed, examine for 10 days. If not pleased, return in original form for refund. •Add 7% (up to a maximum of $10) for shipping, handling and insurance. •For foreign orders add 15% for surface mail. •COD (USA only): add $4.50. •Orders under $20, add $3.00. •NY residents, add 7% sales tax. •90-day parts warranty on kits. •1-year parts & labor warranty on wired units.

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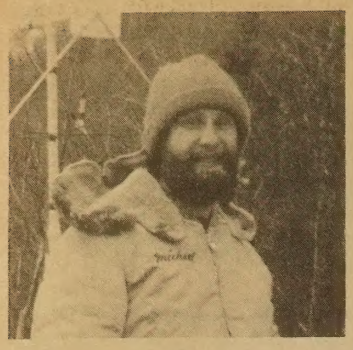

the tech side

by Michael Jay Geier KB1UM

FM and Batteries

Last month we discussed the various kinds of modulation. Let's finish that up, then move on to something new.

In the early days of broadcasting, AM was the only voice mode. It was quite popular (as it still is), and a simple radio could be built from no more than a coil, a capacitor, a diode and headphones. Listeners wound their own coils around Quaker Oats oatmeal boxes because they were cylindrical. Even then, it was "the right thing to do."

By the way, the diode was made from a piece of galena crystal with a very thin wire, called a cat's whisker, touching it. You moved the wire around until you got a good signal. This all happened before the amplifying tube was invented, so the semiconductor actually predates the tube! It took many more years, of course, before an *amplifying* semiconductor, the transistor, was invented.

As technology progressed, the tube permitted loudspeaker operation, and people began to become interested in the fidelity of what they heard. AM had a big limitation in that regard, and something better was inevitable.

Enter Edwin

Edwin Armstrong, the inventor of the superheterodyne receiver, was quite a radio pioneer. He helped develop broadcasting, and he wanted radio to sound as good as it possibly could. He understood that AM's primary limitation was that it was sensitive to static. This interference was caused by many things, including automobile ignition, lightning, electric motors, arc lamps and just about anything else that made a spark.

The reason that AM is so susceptible to static is that the amplitude variations caused by electrical discharges are essentially indistinguishable from the signals themselves. After all, you are decoding changes in strength of the received signal, and discharges just look like rising signal strength. Armstrong reasoned that if some other facet of the carrier could be utilized to carry the message, the receiver could be made insensitive to amplitude variations and static could be eliminated. He found a way: It's called FM.

Let's Wiggle

In frequency modulation, the frequency of the carrier is wiggled back and forth in step with the audio modulation. As the voltage of the audio signal rises, the carrier moves away from its "default" frequency. The higher the audio voltage, the greater the deviation.

What's the point? Well, the amplitude of the transmitter's signal no longer represents the message being sent, and in fact, does not change. This permits a receiver design which can be optimized to remove static by being totally insensitive to the amplitude pulses it causes. Static doesn't wiggle the carrier frequency, so it doesn't get heard! But how do we make such a receiver?

Getting Clipped

Any amplifying stage has limits; no amplifier can operate beyond its power supply voltages. It's like a roller coaster with a ceiling; if you try to go too high, you'll get squashed. In most applications, we try to avoid those limits because crashing into them will generate tremendous distortion in the amplified signal. In this case, though, we deliberately operate the IF (intermediate frequency) amplifiers of our receiver beyond their limits.

Remember, the signal is still a wiggling carrier, not audio, so we aren't going to distort the sound, just the shape of the carrier wave. What comes out of the clipper amplifier (also called a limiter) is a signal with flat tops and bottoms. Any static pulses riding on it have been squashed flat. This signal still wiggles back and forth in frequency, though, so it still contains the information we want. The FM detector converts those wiggles into the original audio. The result is high-fidelity sound with great immunity to static interference.

The technique works so well that it is used in many applications where noise must be reduced, such as satellite TV and video recording. By the way, that whooshing sound you hear when an FM receiver is tuned to a blank frequency is caused by random noise in the receiver's components being amplified to great proportions by the clipping stages.

Capture Me

With AM, even a weak interfering signal causes significant noise in the received audio. That's because the two signals algebraically add and subtract in the receiver. The resultant signal has elements from, and therefore information from, both.

With FM, the weaker signal is squashed in the limiter and only the stronger one is heard. In fact, as long as the stronger one is more than a few decibels higher, the weaker one will disappear altogether! It's called the capture effect, and is what we hams mean when we say that one station "captured the repeater" during an accidental double transmission.

Although FM has the obvious noise advantage, it also has some disadvantages. First, the transmitter is always operating at maximum power output, so it must have a big power supply and be able to handle the heat and other problems associated with lots of power.

Second, reflections from buildings, mountains, and other objects, which cause multiple signals arriving out of phase (absolute position in time) with each other, affect FM worse than they do other modes.

Finally, FM generates bigger sidebands than other modes due to there being sidebands from the carrier deviation along with the deviation itself. As a result, it eats more spectrum space. Also, because the transmitter's energy is spread over a wider bandwidth, it appears weaker at the receiver. So, a given amount of power goes far less distance than it would on SSB or even AM.

Why Use It?

While it's lousy for worldwide DX, FM excels for local communications. Yes, if your walkie were SSB or AM, it would carry much farther than it does now. Noise and interference, though, would be much worse. Especially in automotive applications, the increased noise would cancel out the extra range, and you'd wind up

with much *less* range than you get with FM. And we can make up for the lack of range with repeaters placed in high, advantageous locations. Overall, FM is the best choice for our handhelds and mobiles.

A Little More History

By the time Armstrong developed FM, AM broadcasting was a big industry. Because the new technology required completely new transmitters and receivers that could obsolete AM, the businessmen were very upset at the prospect of its introduction. They set about to ruin Armstrong, even though he had invented most of the AM technologies by which they made their livings. They sued him to try to overturn his patents and succeeded in draining nearly all of his considerable assets through legal fees. In the end, the great man jumped out a window to his death. Ultimately, his achievements were recognized by the American Society of Inventors.

Well, that about covers it for the various kinds of modulation. There are some other exotic types, such as pulse and spread spectrum, but they are not in common use nor fully developed. Now, let's start a new topic.

More Power to Ya

From what I hear on the air, there's a lot of confusion regarding batteries, milliamp-hours and watts. So, let's take a look at batteries.

The most common type of battery used by hams is the nickel-cadmium, or NiCd pack. We call them nicads, although that's actually a tradename—Nicads™. These batteries have the great advantage that you can recharge them many times. When you're powering something as demanding as a transmitter, you sure don't want to waste dozens or even hundreds of alkaline cells when you can use just one NiCd pack.

Although a NiCd has less power than an equivalent-sized alkaline cell, it has a flatter discharge curve, which helps make up the difference. By that I mean that the output voltage stays fairly constant from full charge to discharged, while an alkaline's voltage drops at a regular rate. So, although the alkaline's total power may be greater, many devices may not be able to use the power available in a weak cell because the voltage has dropped too far. That's why a 500-milliamp NiCd may last about two-thirds as long as an 1800-milliamp alkaline.

Memory

No, not the song. NiCds suffer from an effect called memory, in which a cell that keeps getting recharged after being only, say, half discharged, begins to deliver no more than half its normal time. Despite ad claims and articles to the contrary, memory is real. Virtually every NiCd I have ever owned (and that's quite a few!) has suffered from it to some degree, even though I am careful to fully discharge the cells before recharging.

The reason it still happens is that NiCds can get the same effect if they are not used for long periods. I don't use my walkie and camcorder enough to keep the NiCds in good condition. The cure is simple: exercise. If your battery starts giving you significantly shortened operating time, run it down and charge it up. Do this five or six times. Usually, that'll fix it. If not, you may need a new battery. Unfortunately, advanced memory cases seem to be incurable.

Watts 'n' Volts

Batteries are rated in two ways, by voltage and milliamps. The voltage rating is obvious: A 7.2 volt battery delivers 7.2 volts for most of its charge cycle. By the way, the reason for the fractional voltages is that NiCds deliver 1.2 volts per cell, so the final voltage is always a multiple of that value.

The milliamp rating is not so obvious. Here's what it means: A 500-milliamp battery will deliver 500 milliamps for one hour before it is exhausted and its voltage drops. (In reality, such a battery won't go that long, because the ratings are taken at a slower discharge rate, such as over a 20-hour period, and then calculated. A real battery gets used up a bit faster at a higher discharge rate.) So, let's say you have a 500-mil battery and your transmitter requires 1000 mils (one amp). You should be able to transmit for about half an hour before the battery dies.

These ratings have nothing directly to do with the power output of your transmitter. When someone says, "I am using the 2-watt battery," he or she means that that battery makes the transmitter produce 2 watts of RF. That is governed by the battery's *voltage*, not by the milliamp rating. A 7.2-volt 200-mil battery will make the walkie produce the same power output as a 7.2-volt 600-mil pack. The 200-mil pack will simply die in about a third the time.

Well, there's lots more to discuss, but I'm out of space. 'Till next month, 73 from KB1UM. RF

Contact Michael Geier K1BUM care of Radio Fun, *Forest Rd., Hancock NH 03449.*

try something new

by Bill Brown WB8ELK

HF Beacons

Wouldn't it be great if there were a way to instantly tell if you could talk to a certain part of the country or the world? Well, there is! Just find the appropriate beacon transmitter (see Tables 1 and 2), and take a listen. If you can hear that beacon, then propagation conditions for that part of the world are good.

A beacon usually consists of a low power transmitter which sends out a repeating CW message. You can tell if you're listening to a beacon because beacons usually have a /B (for beacon) added to their callsigns. Although you can find a large number of beacons on the bands from 6m on up through the microwave frequencies, this month we'll concentrate on the ones you can listen to in the 20, 15 and 10 meter bands.

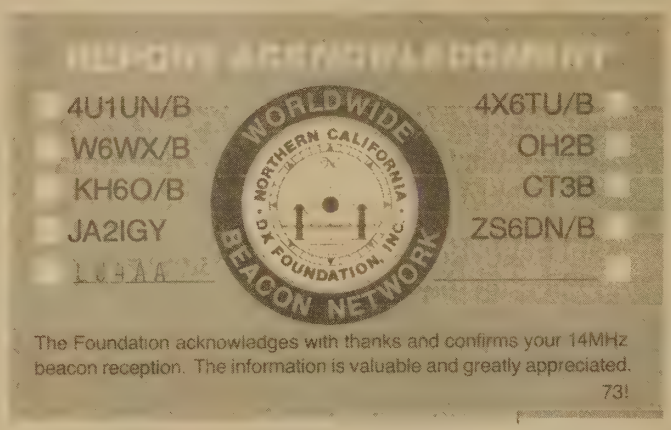

Photo A. QSL card confirming reception report of the NCDXF worldwide beacon network.

The 14.100 MHz NCDXF System

The Northern California DX Foundation, Inc. sponsors a worldwide beacon system on 14.100 MHz. There are currently eight beacons scattered around the world which alternate transmissions on a 10 minute schedule (see Table 1 for times and locations). Most of the beacons consist of a microcontroller which keys a Kenwood TS-130. The most unique feature of these beacons is the power step function. Each beacon starts out at 100 watts and decreases power three times (all the way down to 100 milliwatts) during the one-minute transmission. The sequence is as follows: QST QST de (callsign), 9-second dash at 100 watts, 2 dits followed by a 9-second dash at 10 watts, 3 dits followed by a 9-second dash at 1 watt, 4 dits followed by a 9-second dash at 0.1 watt, SK de (callsign) at 100 watts. Then the next beacon station in the list comes on line with the same format. This process continues on around the world. This system is really fun to listen to, and I think you'll be surprised just how well you pick up the 100 milliwatt transmissions!

Currently the W6WX beacon transmitter at Stanford, California, also operates on the 15 and 10 meter bands. After it sends out its transmission on 14.100 (minute 1), the transmitter switches to 21.150 MHz (minute 2) and sends out the same 1-minute sequence that it does on 20 meters, then it goes to 28.200 MHz (minute 3).

This worldwide beacon system was the result of work done by Mike Villard W6QYT, Dave Leeson W6QHS, Jack Curtis K6KU and Cam Pierce K6RU. The folks at the NCDXF would like to receive your reception reports on the beacons. Indicate the time of reception, which stations you can copy in a 10-minute period, and the number of power levels copied. Send these reports to Al Lotze W6RQ at 46 Cragmont Ave., San Francisco CA 94116 to receive a special QSL card (see Photo A.)

Table 1. The NCDXF Worldwide Beacon System

Minute#	Callsign	Location
00	4U1UN/B	New York City (United Nations Building)
01*	W6WX/B	Palo Alto, California (Stanford University)
02	KH6O/B	Oahu, Hawaii
03	JA2IGY	Ise City, Japan
04	4X6TU/B	Tel Aviv, Israel
05	OH2B	Espoo, Finland
06	CT3B	Funchal, Madeira Island
07	ZS6DN/B	Pretoria, South Africa
08	LU4AA	Buenos Aires, Argentina
09	No transmissions	

*W6WX transmits on 21.150 MHz at minute 02 and on 28.200 MHz at minute 03.

NCDXF 1-minute beacon sequence:

QST QST de CALLSIGN (100 watts)
———— (100 watts)
.. ———— (10 watts)
... ———— (1 watt)
.... ———— (0.1 watt)
SK de CALLSIGN (100 watts)

10-Meter Beacons

Most of the 10-meter beacons operate from 28.190—28.300 MHz. A few can be found on other frequencies in the band as well. With the exception of the W6WX NCDXF beacon, most of these systems are low power and send out a repeating CW message. As you can see from Table 2, there is quite a number of 10-meter beacons scattered across the world. If 10 meters is open, you're likely to hear at least one of these. Listening to these beacons is a great way to study propagation and find out when the best times are for contacts to various parts of the world. Not only that, they provide you with a good source of code practice!

RF

Table 2. The 10-Meter Beacon List

(compiled by K2OLG)

Freq.	Call	Location	Equipment
28.175	VE3TEN	Ottawa, Ont.	10W, GP
28.191	VE6YF	Edmonton, Alta.	10W
28.195	IY4M	Bologna, Italy	20W, 5/8 GP, Robot
28.200	GB3SX	Crowborough, England	8W, Dipole
28.201	LU8ED	Argentina	5W
28.202	KE5GY	Arlington, TX	5W, Vertical
28.2025	ZS5VHF	Natal, RSA	5W, GP
28.204	DL0IGI	Germany	100W, Vertical Dipole
28.205	KA3OEM	Meadville, PA	27W, Yagi/West
28.206	KJ4X	Pickens, SC	2W, Vertical
28.2075	W8FKL	Venice, FL	10W Vertical
28.208	WA1IOB	Marlboro, MA	75W, Vertical
28.209	NX2O	Staten Island, NY	10W, GP
28.210	3B8MS	Mauritius	GP
28.210	K4KMZ	Elizabethtown, KY	20W, Vertical
28.210	KC4DPC	Wilmington, NC	4W, Dipole
28.212	EA6RCM	Palma de Mallorca	4W, 5 El Yagi NNE
28.2125	ZD9GI	Gough Island	GP
28.215	KA9SZX	Champaign, IL	2W, Vertical
28.216	GB3RAL	Slough, England	20W, GP
28.2175	WB9VMY	Calumet, OK	2W, Dipole
28.218	W8UR	Mackinac Island, MI	0.5W, Vertical
28.2185	PT8AA	Rio Branco, Brazil	5W, GP
28.2195	LU4XS	Cape Horn, Argentina	
28.220	5B4CY	Cyprus	26W, GP
28.221	PY2GOB	Sao Paulo, Brazil	15W, Vertical
28.222	W9UXO	NR Chicago, IL	10W, GP
28.2225	HG2BHA	Tapolca, Hungary	10W, GP
28.225	N6TWX	Grass Valley, CA	30W, 3 El Yagi
28.225	KW7Y	Everett, WA	4W, Omni
28.225	PY2AMI	Sao Paulo, Brazil	5W, Dipole
28.2275	EA6AU	Mallorca, Balearic Is.	10W, 5/8 GP
28.230	ZL2MHF	Mt. Climie, New Zealand	50W, Vertical Dipole
28.232	W7JPI	Sonoita, AZ	5W, 3 El Yagi NE
28.233	KD4EC	Jupiter, FL	7W, GP
28.235	VP9BA	Hamilton, Bermuda	10W, GP
28.237	NV6A	San Diego, CA	0.5W, Vertical
28.2375	LA5TEN	Oslo, Norway	10W, 5/8 GP
28.2405	5Z4ERR	Kiambu, Kenya	
28.244	WA6APQ	Long Beach, CA	
28.245	A92C	Bahrain	Dipole NW/SE
28.2455	ZS1CTB	Capetown, RSA	20W, 1/4 Vertical
28.246	N8KHE	Mackinaw, MI	0.050W, Vertical
28.2475	EA2HB	Spain	6W, GP
28.248	K1BZ	Belfast, ME	5W, Vertical Dipole
28.2495	EA3JA	Barcelona, Spain	
28.250	W3SV	Elverson, PA	10W, Vertical
28.250	K0HTF	Des Moines, IA	2W, GP
28.250	Z21ANB	Bulawayo, Zimbabwe	15W, GP
28.250	N4MW	EM55	
28.2505	4N3ZHK	Mt. Kum, Yugoslavia	1W, Vertical
28.252	WJ7X	Seattle, WA	5W, Ringo
28.252	WB4JHS	Florissant, MO	7W, Vertical
28.2525	OH2TEN	Finland	
28.255	LU1UG	G Ral Pico, Argentina	5W, GP
28.2575	DK0TEN	Arbeitsgen, Germany	40W, GP
28.259	WB9FVR	Pembroke Pines, FL	1W, Dipole
28.260	VK5WI	Adelaide, Australia	10W, GP
28.262	VK2RSY	Sydney, NSW, Australia	25W, GP
28.264	VK6RWA	Perth, WA, Australia	
28.265	VK4RIK	Cairns, Australia	
28.266	VK6RTW	Albany, WA, Australia	
28.266	KB4UPI	Birmington, AL	20W, 1/4 Vertical
28.268	VK8VF	Darwin, Australia	
28.2685	W9KFO	Eaton, IL	0.750W, Vertical
28.270	ZS6PW	Pretoria, RSA	10W, 3 El Yagi
28.270	VK4RTL	Townsville, QLD, Australia	
28.2705	KF4MS	St. Petersburg, FL	5W
28.2725	9L1FTN	Freetown, Sierra Leone	10W, Vertical Dipole
28.2745	ZS1LA	Stillbay, RSA	20W, 3 El Yagi/NW
28.275	AL7GQ	Denver, CO	1W, Loop
28.2755	N6RDX	Stockton, CA	20W, 3 El Yagi
28.277	DF0AAB	Keil, Germany	10W, GP
28.278	N0JAR	Newton, IA	
28.280	LU8EB	Argentina	5W
28.280	NO6J	So. California	5W
28.282	VE1MUF	Fredrickton, NB, Canada	0.5W, Dipole
28.282	VE2HOT	Beaconsfield, QUE., Canada	5W, Vertical Dipole
28.2825	OK0EG	Hradec Kralove, Czech	10W, Dipole
28.284	VP8ADE	Adelaide Is., NR Antartica	8W, V Beam to England
28.286	KE2DI	NR Rochester, NY	2W, Vertical Dipole
28.286	KK4M	Las Vegas, NV	5W, Vertical
28.287	W8OMV	NR Ashville, NC	5W, GP
28.287	H44SI	Solomon Is.	15W
28.288	W2NZH	Moorestown, NJ	3W GP
28.290	SK5TEN	Sweden	
28.290	VS6TEN	Hong Kong	10W, Vertical
28.291	KB9NV		
28.292	ZD8HF	Ascension Island	
28.2925	LU2FFV	San Jorge, Argentina	5W, GP
28.294	KE0UL	Greeley, CO	5W, Omni-V
28.295	WC8E	Cincinnati, OH	10W, Ringo
28.295	W3VD	Laurel, MD	1.5W Vertical Dipole
28.297	WA4DJS	Ft. Lauderdale, FL	30W, GP
28.3025	PT7AAC	Fortaleza, Brazil	5W, GP
28.315	ZS6DN	Irene, RSA	100W, Vertical
28.888	W6IRT	Hollywood, CA	5W, GP - Code Practice
28.992	DF0ANN	Motitzberg, Germany	0.02W, 1 El Delta Log

letters

Continued from page 5

test day. Real tone code was a snap after listening to buzzers and watching flashing lights in the middle of the night.

Although QSOs can be long and enjoyable, the mode's demand for brevity is dominant. A recent contact with Australia is a good example. After exchanging reports, the VK suggested I turn my beam to the long path. I replied: "ant longwire N/S—I cpy a slight echo—me thinks we hear both of you." The VK replied: "ant dipole runs East West so no help but broadside to your ends. 73." It made me wonder which of us was "down under."

Once when asked during a CW QSO about my start in amateur radio, I found myself searching for the long and the short of it. At age 12, I wanted to play the drums. Got a key instead. Why CW? It clearly promotes a different set of brain cells. And there is no greater feeling than consciously realizing you are copying 10 wpm without missing a beat, even as other thoughts are crossing your mind. To stay fit, I use a door chime button for a key. Not only was the price right, but it has a stiffer action than most keys. Great hand exercise.

When I recently asked for a telegraph key in a local electronic outlet, the young man said: "Why, sir, no one has asked me for a key in more than five years." When it became obvious that he was smug not to have to produce one, I said: "Well, young man, that is more of a reflection on you than it is on me." You know the place I mean. They have the audacity to have trademarked the traditional term for the radio room. Any more, I refer all TVI problems to them. They're the experts, after all. But then, times are different. A major tire manufacturer has trademarked the term "air supply." Too bad a rock 'n' roll band didn't get it first.

Why CW? It's a skill. Try making an intelligible message clicking two rocks together and you'll see what I mean. CW is a quantum leap over throwing stones. Besides, CW is so efficient in terms of energy consumption that it would be the mode of choice in an emergency where limited power is available. To put it briefly: "Why fight it? We need it."

Kenneth R. Wells V73CT/KC6WHZ, Marshall Islands I have seen numerous letters from hams from both sides of the no-code issue. I am a new ham as an *indirect* result of the no-code license class. About a year ago, I attended a local amateur radio club meeting. They advertised that information would be presented on the new class of license available. I attended and listened carefully. I learned that the Technician class license was changed, and no code test was required. I also learned that there would be no difference in the callsigns between the REAL Technicians and the No-Code Technicians. The only difference was that the REAL Technicians could use the HF bands. There would be no way to tell the REAL Technicians from the No-Code Technicians.

I decided right then that I was not interested in being a Technician with a stigma attached by old-timer hams. I began studying for my Novice exam that evening. I figured that even if I never upgraded, I would never be classified as not being a REAL Technician. On May 8, 1991, I passed my Novice. I continued to study for an upgrade. I became an amateur Extra on August 3, 1991. Not too bad, Novice to Extra in three months. So much for the No-Code Technician stigma.

Since I live on Kwajalein Island (V7), I make many U.S. contacts. For the sake of the Novice and Technician Plus operators, I usually work the Novice subband when I am on 10 meters. I am always pleased to hear the new hams on the air. I am even happier to hear that they are new and that I am their first DX contact or first V7 contact. I will admit that the QSOs are not as polished as the Generals' on 20 meters. But who cares! I have patience with the new hams. I believe that if I was not almost rare DX, the old-timers would not be very patient with me.

It is surprising how warm and friendly everybody is when they hear my QTH. I encourage you old-timers to show the other new hams the same courtesy, patience, and enthusiasm you show me. I had my first QSO on August 25. I learned a lot on the first night. I had no choice, with a two-hour-long pile-up and about 160 contacts. Now I have over 3,000 in the log.

Deborah Riehl KB7NFL, Bothell WA I'm a new Tech+ who got involved in ham radio for search-and-rescue. Since then, I've discovered lots of other fun aspects of the hobby and am studying for my General. As soon as I got my 2 meter handheld, I began monitoring the SAR repeater 24 hours a day. Last summer in the wee hours of the morning I was awakened by the sheriff calling the Operations Leader on 2 meters, and it occurred to me that the O.L. that night was not a ham. (He soon will be!) I grabbed my radio and ran out to the spot in my driveway where I can usually hit the repeater. No dice. To increase my elevation, I put up my extension ladder and climbed to my roof peak. From there, the sheriff and I held a long discourse in the rain. Then I made some phone calls. Since then, my elmer has helped me put up a quarter-wave on the roof.

Deborah sent along this "artist's rendition" of the event described in her letter — Ed.

Bill Herbert KE8NU, Lake Milton OH Enclosed are photos of a 2 meter quad antenna that I built from the article by WA6HNO in the September issue of *Radio Fun*. The article was written in a very clear and understandable manner, and it was very enjoyable to work from his instructions.

I decided to build the antenna in a 4-element version. I used a 1" piece of of schedule 80 PVC pipe for the boom, with a 1" piece of maple dowel rod driven inside to prevent any boom sag. The hubs also were made of maple, drilled for 5/8" maple spreaders and pinned to the boom (after tuning) to maintain alignment and spacing. After these were assembled, they were coated with three coats of G.E. Glyptol red varnish for insulating and weatherproofing wood parts.

Next came the elements. Here I decided to use 1/4" copper tubing held in place with heavy plastic wire straps and screws. The boom to mast plate was made of 3/4" thick Lexan plastic.

After assembly, it took only very little time to obtain a 1.2 to 1.8 VSWR across the entire band. Tuning was accomplished by moving spacing on the

Bill KE8NU made this 4-element, 2m quad from an article in the September issue of *Radio Fun*.

directors only. With the antenna fed with RG-8 coax and mounted at 37 feet, I have no problem working mobile stations 30 to 50 miles, and repeaters 30 to 60 miles, distant.

Congratulations on your new magazine. I find it very enjoyable and interesting due to your format and selection of articles. I am very pleased that I subscribed. I look forward to every issue to see what I might find to enjoy. So far, four issues, zero disappointments. RF

Tesla Update!

From the December 1991 issue of *Worldradio* comes a letter and a response from the editor on "Man Out of Time," a short piece published in *Radio Fun* (October 1991) as well as in *Worldradio* (August 1991):

I was disappointed to see in the August issue that Josh Logan WX7K didn't give credit in his informative article entitled "Man Out of Time" to Margaret Cheney, the author of the book *Tesla: Man Out of Time*. Her book, I think, is *the* single book on Tesla. It's in paperback (i.e., cheap), and I would dare say that probably any library would have a copy. **Garry Parrish AA6GW, Fremont CA.**

There is also an organization, the Tesla Memorial Society, Inc., whose purpose is "to honor and perpetuate the memory and ideals of the great scientist and inventor, Nikola Tesla, through appropriate academic conferences, scholarship awards, and various cultural activities." It is a non-political and nonprofit organization. Currently the society is working to dispell the belief that Thomas Edison was primarily responsible for developing our present system of electrical energy. For more information on the Tesla Memorial Society, write to 453 Martin Rd., Lackawanna, NY 14218.

Cheap and Simple Antennas

How about some coat hanger magic?

Sing Li VE3TMY

Ex-x-xcellen-n-n-t!! That's the way I felt when I received the DOC (Canadian FCC equivalent) notice that I'd passed the no-code examination! Like any other enthusiastic new "no coders," I quickly rushed down to the local ham store and started shopping for a simple, portable, low-cost FM transceiver. Two hours and fifteen minutes later, I walked out of the store with the latest, greatest, and most miraculous HT on earth (at least that was how the salesman described it)—an ICOM W2A dual-band transceiver. Thank God for plastic charge cards!

Rendezvous with Reality

Well, after a few serious "Amateur Family Budget Rag-Chew Nets" with my XYL, it was concluded that a similar splurge of the moment might not be beneficial to the family's (and my) health. Despite the limitations, I managed to enjoy many happy QSOs with local and not-so-local hams on the repeaters I could reach via my rubber ducky antenna. However, as with all things in life, one quickly realizes that there's more to ham radio than local FM rag-chews on the HT. Then my eyes became set on the Bigger and Better antenna systems, Packet Operation, Satellites . . . I'd have to go to the ham store and . . . . "No you won't!!" A sudden loud scream emanated from my telepathic XYL in the kitchen.

If the above scenario sounds familiar, you're one of the few in a selected group being driven "back to the basics" of ham radio by twentieth century reality and simple home economics. Surely, hams are not restricted only to the exercise of JAJ (Japanese Appliances Jockeying)! That's right, I thought: I'll make an antenna! That ought to be fun, self-fulfilling, and educational! (Have I read so many *73 Magazines* that I'm starting to sound like Wayne, the publisher, in his editorials?!)

Armed with a copy of *73 Amateur Radio Today,* and a plan to make a "Low Cost Discone Antenna," I visited my local hardware store for the parts. Two weeks and 15 hardware stores later, I still couldn't find a 13"-long lamp pipe with thread on the outside, nor the 3-foot welding rods. Hardware stores up here in Canada sure ain't like those down south!!

Historical Research

A true ham doesn't stand to be discouraged! I visited the local library and searched through the historical archives for old issues of *73*. Out of the numerous antenna construction articles, I've selected a group of extremely simple-to-build antennas to try out. These antennas do not require exotic building materials, and anybody (even the All Thumbs VE3TMY) can put them together in a couple of hours. Best of all, these antennas use only common coat hangers (my XYL is still slightly puzzled by the case of declining coat hangers in our closets) in addition to the required SO-239 or BNC connectors.

Since my transceiver covers both the 2 meter and 70cm bands, the antennas presented here are either "dual band," or can be customized to cover each band. Obviously, I do not claim any originality for any of the antennas presented here. However, I do think a summary of all of these extremely-simple-to-construct antennas would benefit new hams who have intentions to build their own antennas, or who are driven back to basics. Any one of the following antennas will work substantially better than a simple rubber ducky under most conditions.

The Curly Q Dual-Bander

The original plan for making this antenna appeared in the April 1989 issue of *73*. Designed by Bob Witmer W3RW and Ed Clegg W3LOY, the plan can be summarized in one sentence: Take a straight 19" piece of coat hanger and wrap it around a cylinder to make two turns of approximately 0.5" close to the base, then solder the curled end to an SO-239 or BNC connector. See Figure 1. I used a tiny plastic vodka bottle (from those sampler-size liquors) to form the 0.5" curl, but you may use anything available.

My antenna was terminated via an SO-239 connector from Radio Shack (RS 278-201). Initially, for testing, I just jammed the end of the coat hanger into the center pin of the SO-239. After testing, I borrowed a 45 watt soldering iron and fixed it permanently. For typical operating, I tape the antenna to the top of an aluminum video light stand and feed it through a 20-foot RG-8M cable (small diameter, low loss) from Radio Shack (RS 278-1328). The cable was terminated on one end with a "twist on" PL-259 connector (RS 278-191) and at the other end with a "twist on" BNC connector (RS 278-104).

The proper way to connect this to your HT is first by tuning it with an SWR meter (i.e., trim the antenna for lowest SWR). Lacking such a piece of equipment for VHF/UHF tuning, I connected the antenna directly to the HT. Taking the antenna and light stand assembly out to the balcony, formerly inactive frequencies all of a sudden came alive! I was able to hit more repeaters than ever possible on the rubber ducky. This simple antenna works equally well for both the 2 meter and 70cm band.

The Classic Quarter-Wave Ground Plane

With another SO-239 connector and five coat hangers (beware of vicious XYLs), you can make a classic quarter-wave ground plane antenna as documented in *The ARRL Handbook* since the beginning of ham history.

For construction details, see Figure 2. The elements should be first soldered onto the SO-239 connector, and then cut to length. The bending of the four ground plane radials should be done as a last step. Precise element dimensions are quite important for this antenna, especially if you don't have a VHF/UHF SWR meter for tuning.

To cover both the 2 meter and 70cm band, you will have to construct two separate antennas. Performance again is substantially better than that attainable via the rubber ducky. An article detailing the construction of this antenna appeared in the December 1989 issue of *73*. It was entitled "Poor Boy Satellite Station." The author, Allan J. Fox, IV, N5LKJ, was able to work the low orbiting RS-10/11 satellites via this antenna!

Commercially Available

If even twisting and soldering coat hangers is beyond your technical inclinations, equivalent versions of these antennas are readily available commercially. The quarter-wave ground plane antenna is available from MFJ, Cellular Security Group, and others, while a version of the Curly-Q Dual-Bander is available from Comtelco. They are all priced very reasonably (i.e., less than $30.00).

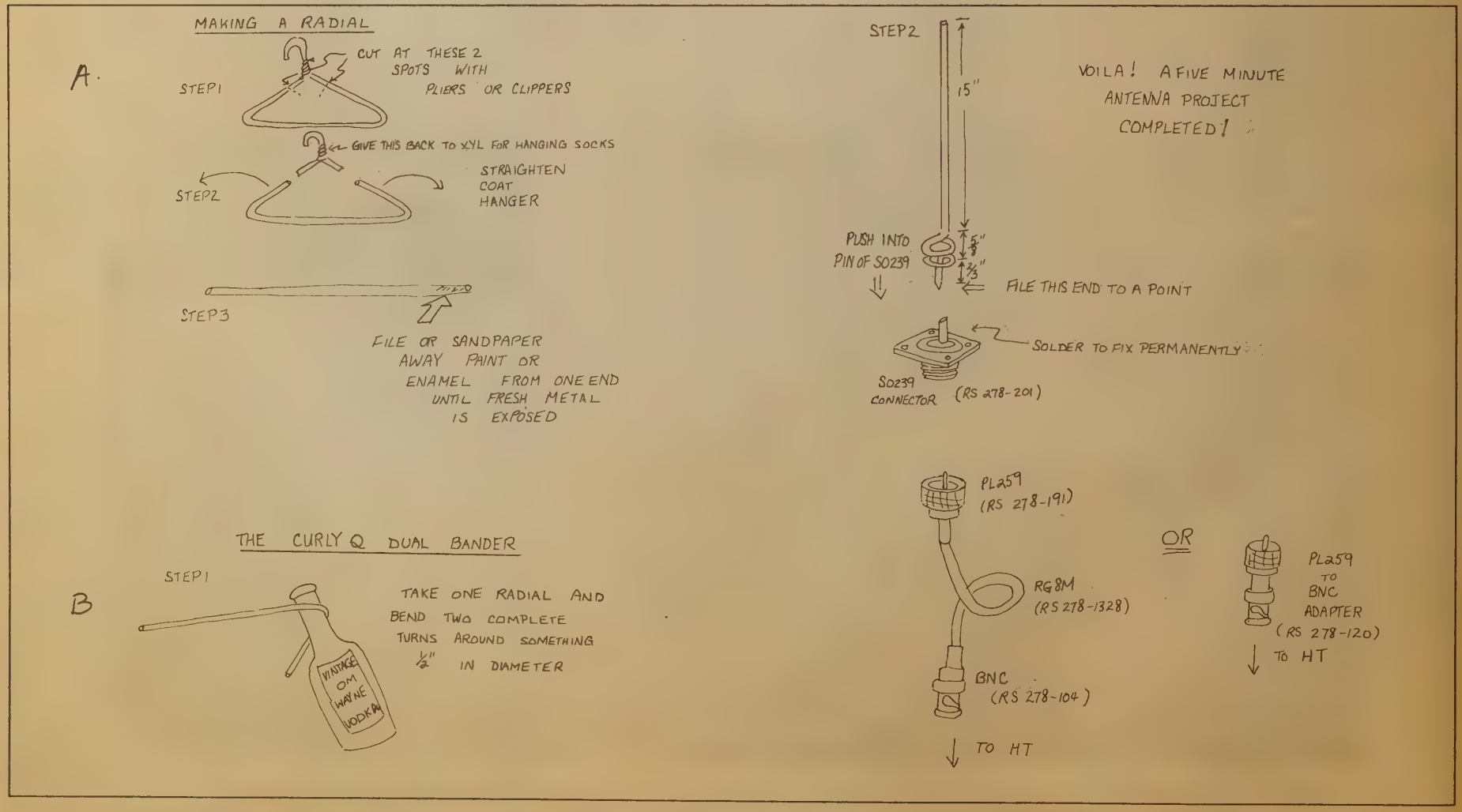

Figure 1. The Curly Q Dual-Bander.

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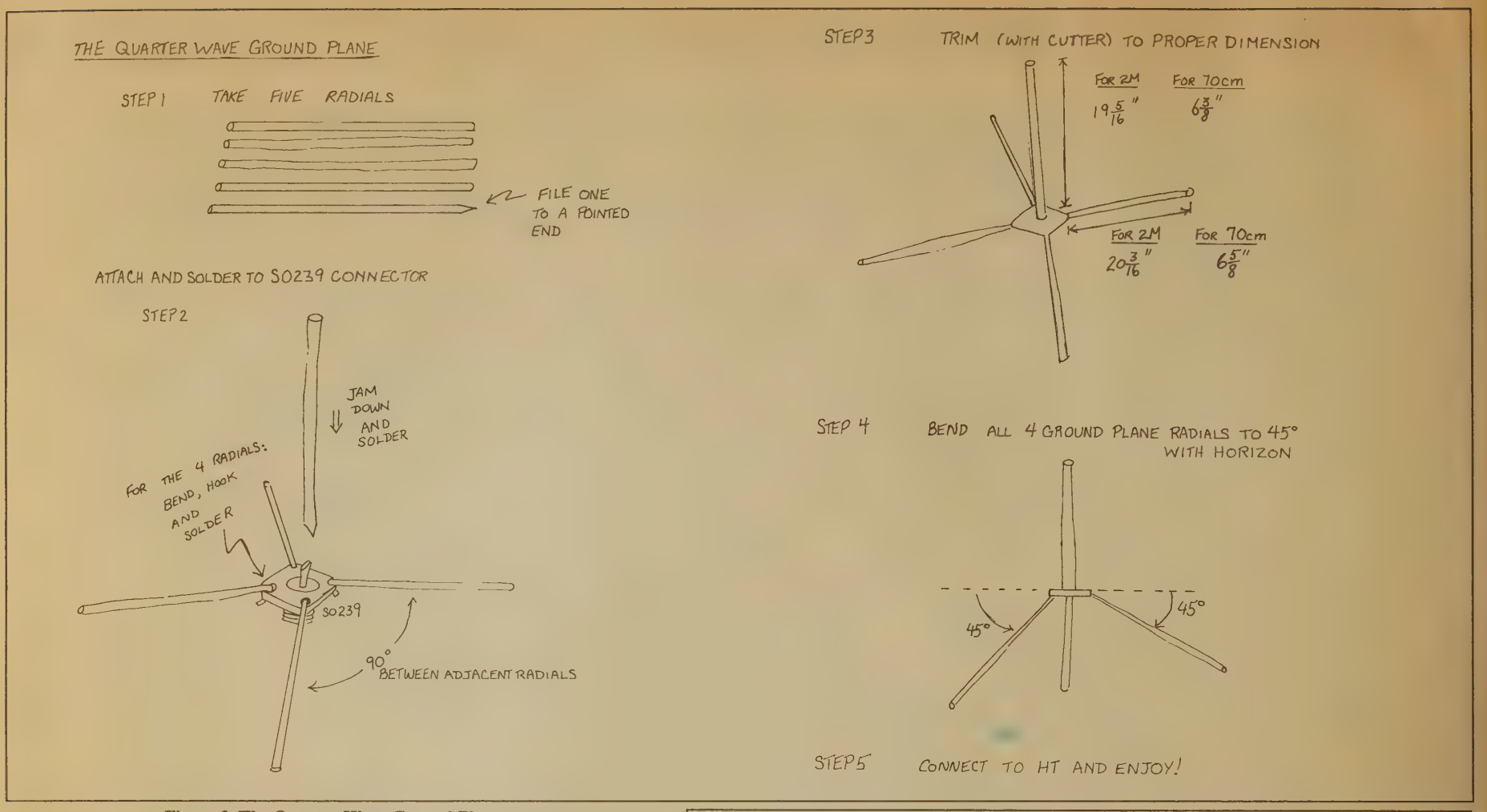

Figure 2. The Quarter-Wave Ground Plane.

Performance Plus

How do these ultra simple and cheap looking gizmos perform? Well, I live on the 22nd floor of a 30-story high-rise apartment building with a southern exposure. Unfortunately, another 30-story apartment building blocks half of my panoramic view south. With the Curly Q Special, I was able to reach repeaters in the Lockport and Buffalo area approximately 80 miles away with consistent S7 levels (and occasionally full quieting). Not bad for a little HT putting out 2 watts!

Exploring a Dirt Cheap Film Discone

I've always been fascinated by the discone antenna because of its extremely wideband coverage (good for both my dual-bander and my scanner). Radio Shack sells a model for about a hundred dollars. Diamond and a few other manufacturers also make commercial versions. To make one with commonly available material typically requires very skillful workmanship and careful design.

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See Figure 3 for a conceptual sketch. Since I don't have any physical construction details for this antenna, I leave it up to you to assemble this as you see fit, as an incentive for further exploration in a true pioneering fashion, just as our ham forefathers did in the past. Just make sure to attach the center of the coax to the top disk and the shield of the coax to the radials on the cone portion. The top disk and the radial cone should be insulated from each other. Once you have completed your antenna, why not write and share the experience with other new hams (like yours truly).

Sing W. Li VE3TMY, 20 Edgecliff Golf Way, #918, Toronto Canada M3C 3A4. RF

Photo C. Jay Weaver FY/N4QDX, electrical engineer, and Beth Weaver FY/KD3FK, R.N., are missionaries in French Guiana. TNX KDØJL.

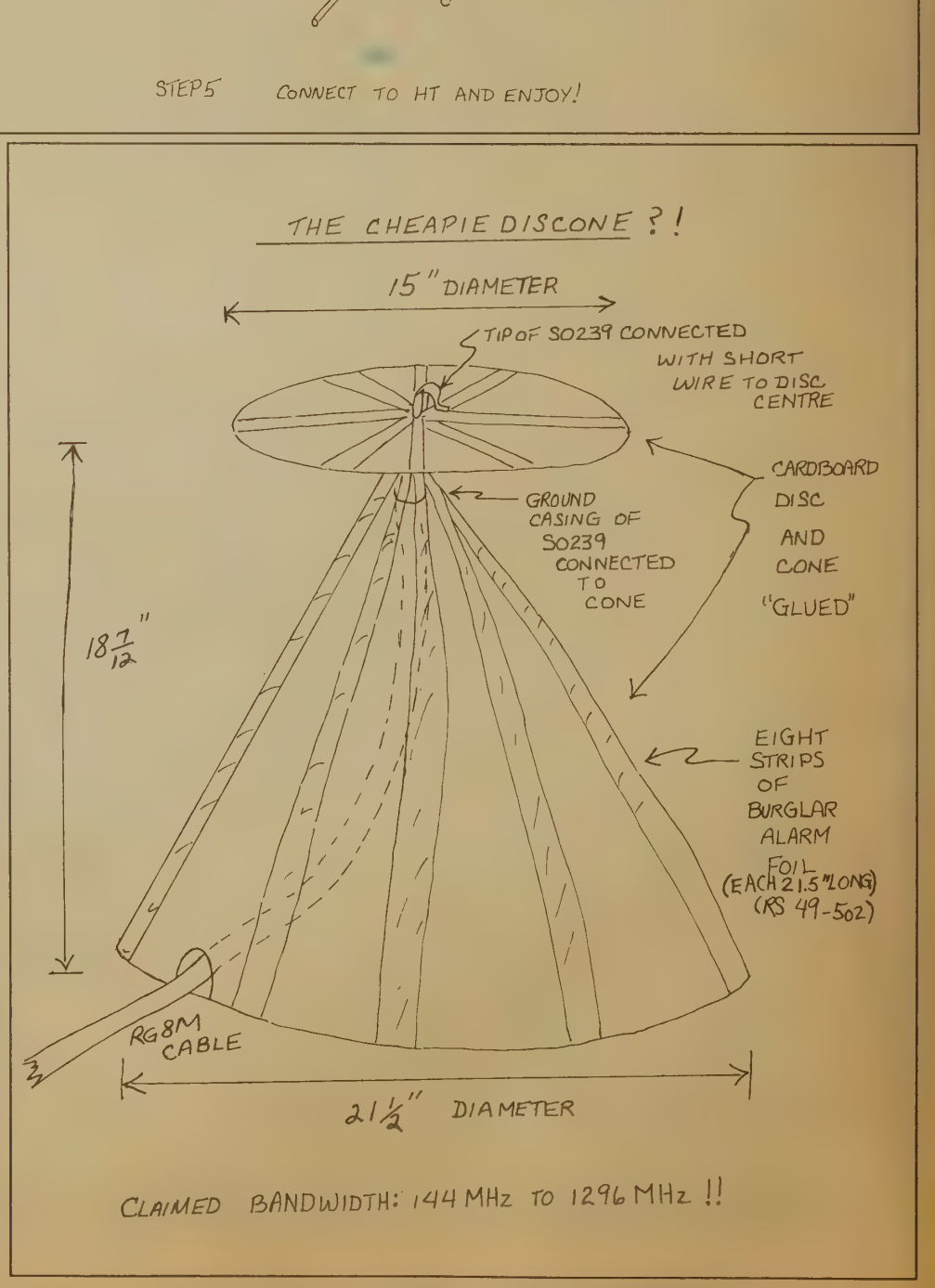

Figure 3. The Low-Cost Discone, with a claimed bandwidth of 144 MHz to 1296 MHz.

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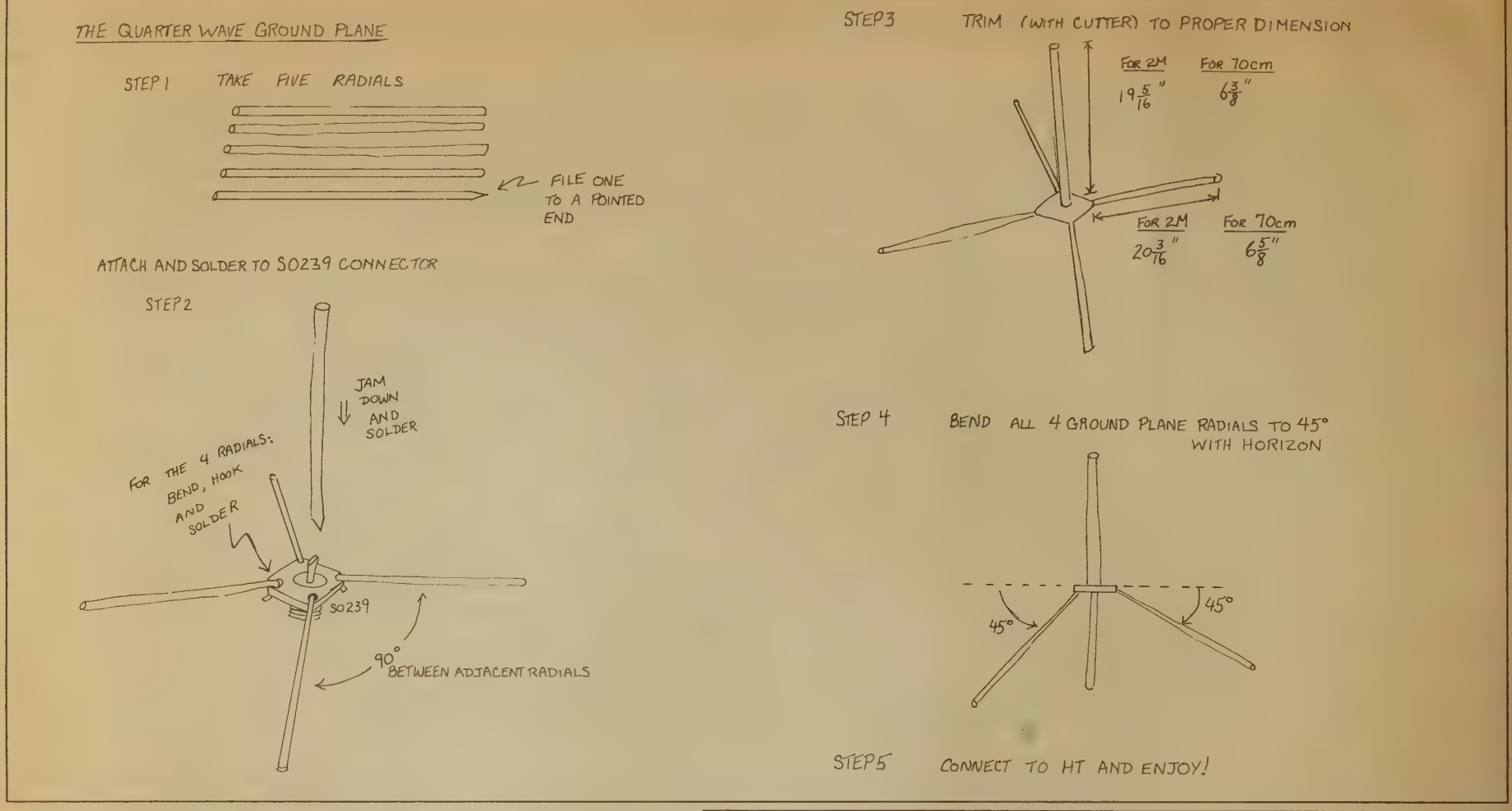

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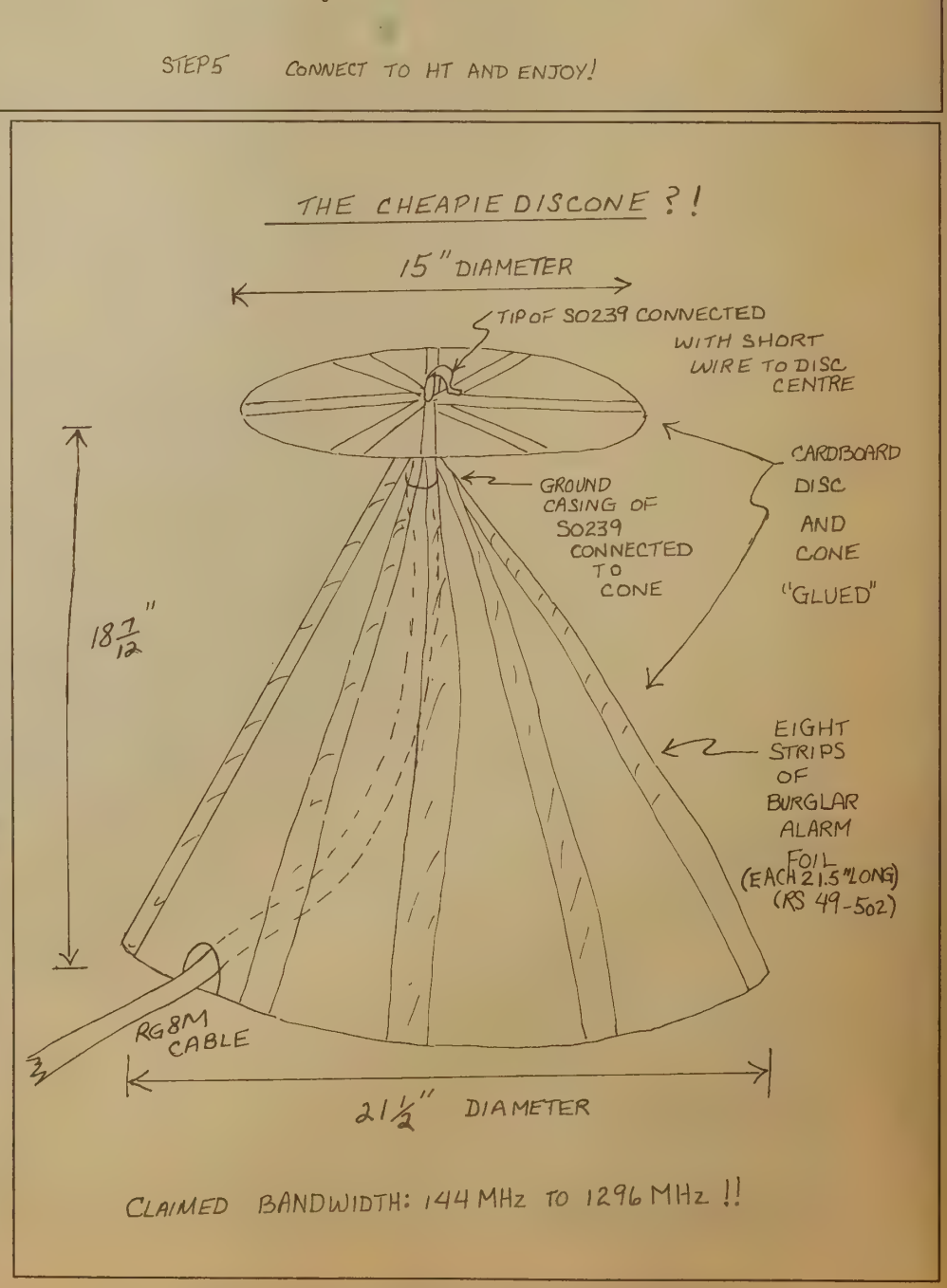

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A First DXpedition

Share an exciting trip, great scenery, lively operating, and some useful suggestions.

by Fred Archibald VE2SEI

For many hams, the heart and soul of their hobby is HF DXing—communicating over global distances with low power, or chasing "the rare ones" for a coveted DXCC award. However, the new ham, after a little DXing, finds that the VE2 or WB4 call which he so proudly received after the big exam is a bit ordinary, and the number of Bouvet Islanders that call him is really quite small. Has there ever existed a ham who hasn't dreamed of being a ZA or XZ and receiving a roar of frantic responses to his most casual CQ?

Such dreams motivated some of the newer, less stable members of the West Island Amateur Radio Club (WIARC) of Montreal to meet in the winter of 1991 to ask, "What nearby, hamless DXCC country can we visit on a beggar's budget?" Surprisingly, the question had a good answer: St. Paul Island, located between Nova Scotia and Newfoundland.

St. Paul is on the border of the Gulf of St. Lawrence and the North Atlantic, where the weather can change from balmy sunshine to a driving gale in hours. It is actually two islands: the larger, deserted southern one (one-half mile by two miles), and the tiny northern one (a few acres). The northern one is inhabited by two lighthouse keepers, lots of grass, and wind. Over the centuries, many ships have foundered on St. Paul's rocks, so the islands are now separately administered by the Canadian Coast Guard (hence the DXCC status, although St. Paul's separation from the mainland is too small to meet present DXCC rules).

Fantasy hardened into reality as we (Jan VE2OL, Fred VE2SEI, Benoit VE2JBF, Alain VE2DAV, Andrew VE2WHO, Don VE2GZV and Mark VE2PTT) got permission from the Coast Guard to visit St. Paul, and Communications Canada issued us the call CY9CWI (nice, as our club call is VE2CWI, but a bit horrible on CW). By April we were beginning to assemble the mass of equipment and supplies needed to keep seven hams fed, comfortable, and radio-active for a week on a tiny island. We decided to go in early August because that time of year provides the best chance of good weather, not a trivial concern in a place where bad weather means either you can't go or you can't return, and a "light breeze" makes a tribander look like stirred noodles. Requests netted us the use of two linears (TNX N6RJ and ICOM), a 3 kW generator (TNX Jim VE2RQ of Dynamic Honda), QSL cards (TNX W4WMQ, INDEXA, W6DU and NCDXF) and a variety of high quality coax, wire, fittings, hats, etc. from Peter VE3NVP of Seaway Communications. Finally, strategically placed WIARC club officers rammed through a proposal to donate $500 to the DXpedition. Somnolent club members may still be wondering what happened to the club's bank balance.

Photo A. The St. Paul Island QTH, as seen from the southern island.

Photo C. CY9CWI, as seen from the lighthouse. The larger house in the foreground is used by the lightstation keepers.

Photo B. A cleft in the rocks with the remains of an old ramp provides the only landing spot.

Getting There

Since Montreal is nearly a thousand miles from Dingwall, N.S., our port of departure, we decided to rent a 15-passenger van and drive straight through. Lacking both sense and dollars, we rented from a "bargain" agency and got an econo-crate with more mileage than Don Wallace's S-line, and steering that had more drift than an SW-3 on 10 meters. However, the feeling that the van was not quite under control turned out to be very helpful in keeping the driver awake at 3 a.m. in New Brunswick.

Anticipation built until July 31st when, after we had had a last supper of burgers, the van (packed to the headliner, and roof adorned with tower sections, masting, a beam, and 10 five-gallon carboys) left Montreal. Nine hundred fifty miles, 22 hours, and much gasoline later we arrived in Dingwall and met Jackie and Nelson Morrison, the sailors who would take us to St. Paul. We then crawled into a motel for a much needed rest and a "last chance" shower.

By 3 p.m. the next day we were safely ashore on St. Paul, thanks to the expert seamanship of the Morrisons, the seaworthiness of the *Elizabeth Ryan* and the firm grips we all took on immovable objects on deck and on our stomachs. We were met by the lightstation keepers, Arnold and Wally McLeod, who not only showed us the hospitality typical of Nova Scotians but even helped drag some of our gear up over the rocks to the abandoned house we were going to use as a shack. It was hard to concentrate on antenna assembly because, after an overcast morning, the sun broke through, illuminating the wild beauty of St. Paul. We were perhaps 60 feet above the surf, and the grass was filled with little flowers. We had a magnificant, unobstructed view across miles of open ocean in all directions, except south where the big island lies across a narrow channel, called "The Tittle."

All hands made a concerted effort, and the three stations of CY9CWI were on the air by 9 p.m. (00:00 UTC Saturday, August 3, 1991). St. Paul now sported an R-5 multiband vertical, a TA-33 tribander and, as the days went by, a Zepp, 80m dipole, and (very) longwire. The rigs used were an IC-751, an IC-735, and an FT-901, a recent graduate of the school of hard knocks. The three stations fit neatly into the two bedrooms and kitchen, leaving the central living room for eating, sleeping, and exaggerating.

On-the-Air

Most of us had been licensed for less than three years, so we learned a lot fast about pile-ups. The first CQ on 14.195 brought in one or two responses, followed on sign off by a dozen calls, followed on sign off by the ravening horde. We were very glad to have our laptops and CT logging program!

My memories of operating are a little blurred—so many contacts on so many bands—but some things stand out. It was fun to sneak away to a quiet frequency and answer a "CQ" from, say, a WB4 looking for something exotic like a KB7 or VE3, with "CY9CWI." "Huh? Where's that? REALLY? Wow!" Personally, I had been lusting for months to demand, "Africa ONLY, please!" And I did. I got two Kenyan stations, and I've never even heard Kenya from the home QTH. Sigh.

Sunday brought bright sun and blue sky and five of us, on the flimsy pretext of erecting a longwire across "The Tittle" and its cliffs, rowed over to the big island and explored, leaving Jan to the tender mercies of the 20m crowd. In fact, the 450-foot wire we erected high above the sea worked very well on 160, 80, 40 and 30m.

Continued on page 30

Photo D. Given the choice between his dinner and a JA pile-up on 20m, Mark VE2PTT keeps workin' them, while Jan VE2OL enters the contacts in his laptop.

Reduced Size Dipoles by Computer

Squeeze your antenna to fit.

by Bill Clarke WA4BLC

Have you ever wanted to build an effective reduced-size antenna that will fit in your back yard? Couldn't find the secret to doing this feat? Too many times I have heard hams say, "I'd sure like to get on the low bands, but my lot is too small for the antennas." Phooey! Here is a means for building reduced-size antennas that work and will fit on nearly any lot. Let your computer do the work for you!

The following short computer program is designed to take all the work out of designing coil-loaded dipole type wire antennas for ham and SWL bands. No more calculations, scrap paper, or "cut and try." These instructions, although applicable to any ham band, are really intended for use on 160, 80, and 40 meters. Those are the bands with the largest antennas.

About the Program

The program is written in GW Basic, as most computer hobbyists understand BASIC and their computers will operate on it. These computers include IBM and clones, Atari, Apple, and Commodore. However, some program modifications may be necessary to allow this program to operate in other than a GW Basic environment. At the end of the program listing are a few hints for operation with Commodore BASIC.

For a complete set of instructions regarding entry of computer program listings, saving your work, and using a new program—see page 22 of the May 1991 issue of *73 Amateur Radio Today*.

The name of the program is REDUCER, and using it is simplicity itself. Each menu is completely self-explanatory. Just enter a frequency and make your selections.

About Reduced-Size Antennas

In the field of antennas, any time you reduce the physical size of an element you will have a compromise antenna. In other words, it will not work as good as the real thing. That is what theory tells us!

In practice, when using antennas down to about 70% size, I have found that there is little discernible difference between a reduced-size and a full-size antenna's performance. However, as the antennas get smaller the bandwidth decreases. A tuner will aid you here, so have no fears.

At the half-size level there is a noticeable difference between a full-size and a reduced-size antenna; but if using a reduced-size antenna allows you onto a band you were restricted from before, due to antenna size, be happy to have it and get on with life. I used a 60% size 160 meter dipole for several years in Virginia, and had a ball with it. Though I didn't win any contests, I was never at a loss for contacts.

Building Instructions

The program shows the lengths of the wire elements and placement of the coils. The coils can be purchased or built. I prefer building them.

I use PVC pipe cut four inches longer than the calculated coil length (two extra inches of pipe extending beyond

Microsoft QuickBASIC™

QuickBASIC is a very powerful version of the BASIC language. To show just how powerful, consider this: Many programmers making their living by writing programs are using QuickBASIC. Of course the purists using C and other difficult programming languages look down upon any form of BASIC. I don't agree with them!

QuickBASIC compiles BASIC programs for lightning-fast operation and freedom from LOAD and RUN statements. A compiled program becomes an ".EXE file" (executable file), and can be transported between any DOS type computer and will operate with no further need for BASIC.

I strongly recommend anyone serious about learning programming to use Microsoft QuickBASIC. It is generally available for less then $65. There is, however, one small problem with getting into programming—you may become one of the missing on the bands when the programmer's bug bites.

The REDUCER program will operate with QuickBASIC, and can be compiled.

Modifications for the Commodore

The following commands must always be replaced as shown:

SPACE$(##) must be removed and the number of spaces manually inserted.

Example: 22 PRINT SPACE$(23); "X - Exit from System"

CLS replaced by PRINT "[shifted}CLEAR/HOME"

CLEAR replaced by CLR

CH$ = INKEY$ replaced by GET CH$ and others similar

line 27 and 28 replace SYSTEM with END

107 FOR X = 1 to 300 : NEXT X

108 GOTO 10

remove line 109

Program Listing

```
10 CLEAR : CLS : GOTO 21
20 FOR X = 1 TO 3: PRINT : NEXT X: RETURN
21 GOSUB 20: PRINT SPACE$(23); "R - Reduce the Size of a Dipole"
22 PRINT SPACE$(23); "X - Exit from System"
23 GOSUB 20
24 PRINT "Enter your selection"
25 CH$ = INKEY$ : IF CH$ = "R" GOTO 100
26 IF CH$ = "r" GOTO 100
27 IF CH$ = "X" THEN SYSTEM
28 IF CH$ = "x" THEN SYSTEM
29 GOTO 25
100 CLS : GOSUB 20
101 INPUT "Enter the Dipole Frequency (MHz) or 0 for menu: "; F$
102 F = VAL(F$) : IF F$ = "0" THEN 10
103 IF F$ = "" THEN 10
104 IF F <.5 OR F> 30 THEN 106
105 L = 468 / F: CLS : GOTO 110
106 GOSUB 20: PRINT SPACE$(20); F$; " MHz is improper"
107 PRINT : PRINT "press ESC to retry"
108 IF INKEY$ = CHR$(27) THEN 10
109 GOTO 108
110 DEF FNA (F) = INT(F * 100 + .5) / 100
111 PRINT "The Frequency is: "; FNA(F); " MHz": PRINT
112 LA = .9 * L
113 LB = .8 * L
114 LC = .7 * L
115 LD = .6 * L
116 LE = .5 * L
117 LF = .4 * L
118 LG = .3 * L
120 PRINT " Selection  % of full size  length in ft": PRINT
121 PRINT "          100          "; FNA(L)
122 PRINT " 1        90           "; FNA(LA)
123 PRINT " 2        80           "; FNA(LB)
124 PRINT " 3        70           "; FNA(LC)
125 PRINT " 4        60           "; FNA(LD)
126 PRINT " 5        50           "; FNA(LE)
127 PRINT " 6        40           "; FNA(LF)
128 PRINT " 7        30           "; FNA(LG)
129 GOSUB 20
130 PRINT " Enter your selection 1-7 (0 for menu)"
131 SA$ = INKEY$ : IF SA$ = "0" GOTO 10
132 IF SA$ = "1" THEN XL = 125: LO = LA: GOTO 140
133 IF SA$ = "2" THEN XL = 250: LO = LB: GOTO 140
134 IF SA$ = "3" THEN XL = 400: LO = LC: GOTO 140
135 IF SA$ = "4" THEN XL = 590: LO = LD: GOTO 140
136 IF SA$ = "5" THEN XL = 800: LO = LE: GOTO 140
137 IF SA$ = "6" THEN XL = 1050: LO = LF: GOTO 140
138 IF SA$ = "7" THEN XL = 1500: LO = LG: GOTO 140
139 GOTO 131
140 CLS : XA = 6.28 * F
141 MH = XL / XA
150 PRINT "The Frequency is: "; FNA(F); " MHz"
152 PRINT "Load Inductance is: "; FNA(MH); " Microhenrys"
153 GOSUB 20
154 PRINT " Select  coil diameter in inches": PRINT
155 PRINT " 1      1 1/2"
156 PRINT " 2      2"
157 PRINT " 3      2 1/2"
158 PRINT " 4      3"
159 GOSUB 20
160 PRINT " Enter your selection 1-4 (0 for menu)"
161 SB$ = INKEY$ : IF SB$ = "0" GOTO 10
162 IF SB$ = "1" THEN DI = 1.5: GOTO 170
163 IF SB$ = "2" THEN DI = 2: GOTO 170
164 IF SB$ = "3" THEN DI = 2.5: GOTO 170
165 IF SB$ = "4" THEN DI = 3: GOTO 170
166 GOTO 161
170 CLS : PRINT "The Design Frequency is: "; FNA(F); "MHz"
171 PRINT "Load Inductance is: "; FNA(MH); " Microhenrys"
172 PRINT "Loading Coil is "; DI; " Inches in Diameter"
173 GOSUB 20
174 PRINT " Select  turns per inch": PRINT
175 PRINT " 1      4"
176 PRINT " 2      6"
177 PRINT " 3      8"
178 PRINT " 4      10"
179 GOSUB 20
180 PRINT " Enter your selection 1-4 (0 for menu)"
181 SC$ = INKEY$ : IF SC$ = "0" GOTO 10
182 IF SC$ = "1" THEN TP = 4: GOTO 200
183 IF SC$ = "2" THEN TP = 6: GOTO 200
184 IF SC$ = "3" THEN TP = 8: GOTO 200
185 IF SC$ = "4" THEN TP = 10: GOTO 200
186 GOTO 181
200 CLS
201 RESTORE
202 READ DA, DB, DC
203 IF DA = DI AND DB = TP GOTO 210
204 GOTO 202
210 DD = DC / 5: TR = DD / TP: TT = MH / TR
211 LH = LO / 2: LJ = LH * .4: LK = LH * .6
212 PRINT " Reduced Size Dipole Plans for "; FNA(F); " MHz": PRINT
213 PRINT " leg -A-  coil  leg -B-  leg -B-  coil  leg -A-"
214 PRINT CHR$(196);
215 FOR X = 1 TO 10: PRINT CHR$(196); : NEXT X: PRINT "/////";
216 FOR X = 1 TO 10: PRINT CHR$(196); : NEXT X: PRINT CHR$(191);
CHR$(218);
217 FOR X = 1 TO 10: PRINT CHR$(196); : NEXT X: PRINT "/////";
218 FOR X = 1 TO 10: PRINT CHR$(196); : NEXT X: PRINT
219 PRINT SPACE$(26); CHR$(24); CHR$(24)
220 PRINT SPACE$(21); "feed point"
221 PRINT
222 PRINT " The Frequency is: "; FNA(F); " MHz"
223 PRINT " The Reduced Length is: "; FNA(LO); " Feet"
224 PRINT " The Load Inductance is: "; FNA(MH); " Microhenrys"
225 PRINT " The Coil Diameter is: "; DI; " Inches"
226 PRINT " The Coil Pitch is: "; TP; " Turns Per Inch":PRINT " The Coil Length
is: ";FNA(TT)/TP; " Inches":PRINT " The Coil Form Length is: ";(FNA(TT)/TP)+4;
" Inches"
227 PRINT " The Number of Turns Used is: "; FNA(TT)
228 PRINT " Antenna Legs -A- are: "; FNA(LK); " Feet Each"
229 PRINT " Antenna legs -B- are: "; FNA(LJ); " Feet Each"
230 PRINT : PRINT " F - Change Frequency"
231 PRINT " C - Change Coils"
232 PRINT " M - Main Menu"
233 CH$ = INKEY$ : IF CH$ = "F" GOTO 100
234 IF CH$ = "f" GOTO 100
235 IF CH$ = "C" GOTO 140
236 IF CH$ = "c" GOTO 140
237 IF CH$ = "M" GOTO 10
238 IF CH$ = "m" GOTO 10
239 GOTO 233
300 DATA 1.5,4,3.9
301 DATA 1.5,6,8.8
302 DATA 1.5,8,15.6
303 DATA 1.5,10,24.5
304 DATA 2,4,6.6
305 DATA 2,6,15
306 DATA 2,8,26.5
307 DATA 2,10,42
308 DATA 2.5,4,10.1
309 DATA 2.5,6,23
310 DATA 2.5,8,41
311 DATA 2.5,10,64
312 DATA 3,4,14
313 DATA 3,6,31.5
314 DATA 3,8,56
315 DATA 3,10,89
```

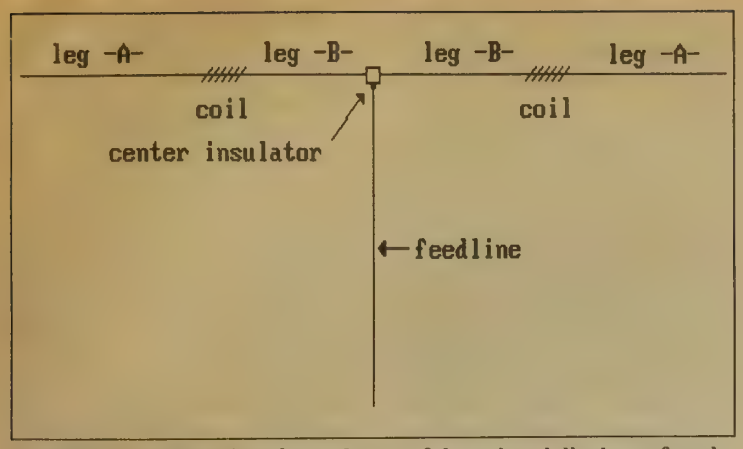

Figure 1. The dimensions for each part of the reduced dipole are found by using the program, which will provide a diagram notated with all the information needed to construct it.

each end of the coil) and wrap wire around to the specifications given by the program. You can use pipe diameters from 1.5 to 3 inches O.D. A couple of holes drilled in each end of the PVC coil forms will provide fastening points for the windings and the antenna elements. A wrapping of plastic tape keeps the coils from moving. The wire I use is #12 insulated house wire, available at any hardware store. Close-wound it will give you about eight turns per inch.

Except for the coils, a reduced-size dipole is constructed just like any other dipole.

Feeding and Tuning

Feed the reduced-size dipole as you would any other standard dipole, with coax—in the center of the span. I don't recommend the use of a balun, but I do suggest using a good quality center insulator.

Tuning the antenna is very easy. If the lowest SWR point is below the frequency you want to operate on, make the antenna shorter by trimming equal lengths from each end (outermost ends). If the lowest SWR point is higher than you wish, increase the antenna's length by adding equal amounts to each end. I suggest you make changes in three-inch increments, rechecking the SWR after each change.

If you use a tuner it is not necessary to adjust the antenna length. Just build the antenna following the computer's instructions and let the tuner do the minor adjusting for you.

Installing the Antenna

As with any wire antenna, you must keep it away from power wires, insulate the ends, keep it high enough in the air to prevent anyone from touching it, and securely fasten it in place. RF

REDUCER.BAS is available for download from the 73MAG file area of the 73 BBS at (603) 525–4438. Also the author will provide a copy of REDUCER.BAS for GW Basic or a similar program for the Commodore 64 for $5. Be sure to indicate the computer you will be using. Send to: Bill Clarke WA4BLC, RR #2 Box 455A, Altamont NY 12009.

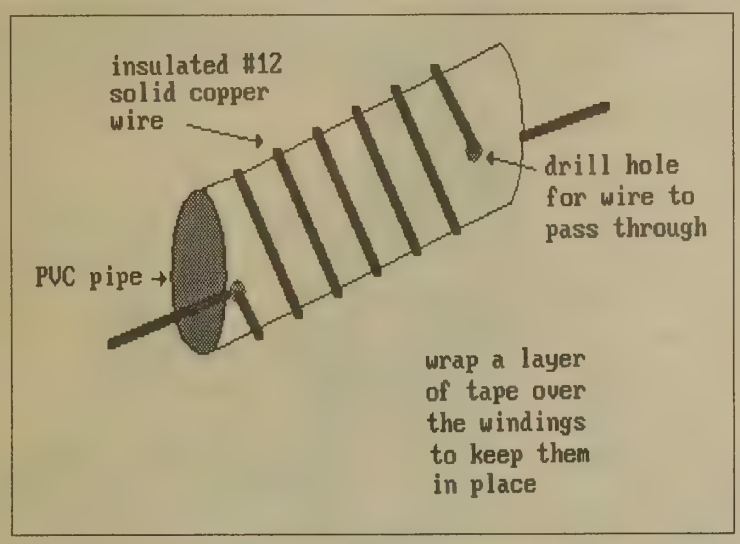

Figure 2. The coil is constructed of wire wound around the PVC coil form, as described by the computer. The holes are 3/16-inch, and act as fastening points for coil ends and leg connections.

About Lightning

At any given moment, there are more than 2,000 thunderstorms taking place. These storms each produce about 100 lightning flashes per second, each one up to a billion volts and at more than 54,000 degrees Farenheit. A moderate-sized thunderstorm can generate several hundred megawatts of electrical energy, or about the output of a small nuclear power plant. With all this energy being released, it's no wonder that we have high noise levels on our radio bands.

With so many bolts of lightning, it's no wonder that people and structures get hit. About 100 people are killed, and 250 are injured by this force each year. Lightning also destroys more than 30,000 buildings each year. All of us have had, or know of, someone who has lost precious radio gear or home electronic devices due to either a direct strike, induced currents, or powerline surges. It's interesting that there's only one documented case of lightning being the direct cause of a commercial airline plane loss, since most planes are struck about once every 3,000 hours of flight time—an average of once a year.

The government, NASA, Air Force, NOAA, and the FAA, as well as several private research foundations and universities have conducted studies on lightning, its cause, its prevention, and general safety procedures.

They have found that ground equipment needs the most protection. Since lightning tends to strike the highest point in any given area, special care must be taken to protect tall structures from these high voltage bolts. As for hams, these structures are often powerlines, telephone lines, and repeater towers, as well as personal antennas. Recent studies show that lightning strikes within one-millionth of a second, with peak currents approaching 200,000 amperes. Conventional protection methods are often unable to save complex electronic gear from some damage. There are, however, some ways to avoid or reduce the possibility of a direct strike at your QTH (location), and keep lightning outside where it is sure to do less damage.

A lightning strike is the transfer of electrical energy from one area to another. Most lightning is cloud-to-cloud. The destructive kind we are talking about is cloud-to-ground, or even ground-to-cloud. Yes, lightning can strike upwards!

When a thundercloud's electrical charges have built up to the point where they exceed the insulating quality of the atmosphere, an electrical discharge occurs in the form of a spark referred to as lightning!

Lightning can be either positive or negative; most of the time, the electrons are negatively charged in cloud-to-ground lightning. As the "leader" from the cloud descends, a positive charge builds on everything from grass to antenna towers. When the leader gets close enough to the positive ground, closure of the cloud-ground circuit occurs, and the leader is neutralized. A much more powerful return stroke returns from the ground to the cloud through the grounded object selected as the focal point of the positive ion flow. That object, person, antenna, or building is then described as having been "struck" by lightning.

From start to finish, the whole process takes less than a second. The return stroke is the part of the event that is most visible to the human eye. A lightning strike is often brighter than 100 million light bulbs. Most lightning strikes are not single discharges, but rather the bolt travels back and forth between the cloud and ground a dozen or more times, as shown in slow-motion photography. With a little practice at not closing your eyes, it's possible to detect several multiple strokes within seconds.

upgrade... don't stop now!

by Gordon West WB6NOA

Choosing Your Volunteer Examiner Team

You could not upgrade without a certified volunteer examination team. Men and women amateur radio operators who are at least 18 years of age, and who hold an Advanced or Extra class license, may serve as a member of a three-person minimum volunteer examination team (VET). These amateur radio operators do not receive compensation for their services. Many will spend over 100 hours a year in the preparation and administration of amateur radio tests.

Also, to be allowed to administer exams, team members may not own any significant interest in amateur radio equipment manufacturing or publications, and they can't work for any business involved in the sales and distribution of ham radio gear (FCC Rule 97.515).

Volunteer examination teams are all over the world, and here in the U.S. one might be just down the street from you. To locate a team and testing time and place near you, contact any VEC (Volunteer Examiner Coordinator), and give your zip code. In a matter of seconds, the VEC can tell you when and where the next upgrade examination in your area will be (see the VEC list).

Find Out All You Can

Your next step is to contact the volunteer examination team leader, and make an appointment to take the upgrade exam. Don't be a surprise "walk-in," or you might be disappointed. They might not have a seat available for you!

You will be asked to bring the following to your upgrade examination:

1. Photo I.D.
2. Your original amateur radio license and one photocopy of it.
3. Your original, and latest, certificate of successful completion, if any, and one photocopy of same.
4. A VEC processing fee of up to $5.44 for the exam may be allowed by the FCC.
5. Headphones may be needed for a code test.
6. Any additional paperwork or hardware requested by the VE team leader.

When you speak with the volunteer examiner who will assist you in setting up your examination date, ask a few questions about the test:

1. Can you retake a different written exam on the spot if you should fail the first one?
2. Can you take additional upgrade written examinations?

If you're planning on taking a code test, you have many questions to ask the examiners:

1. Is the code test multiple choice or fill-in-the-blank?
2. Can you make corrections to your one minute of perfect copy after the test is over?
3. Is the test a typical QSO, and will it start and end with call letters?
4. Will the test use plain language, or many CW abbreviations? Is the test sent from a straight key or an electronic key?
5. Can you retest for a failed code test at the same session?

Taking the CW Test

You must find out about the CW character rate ahead of time. If you have been using traditional exam preparation tapes, the character rate for 5 and 13 wpm is probably 15 wpm. If you have been using ARRL tapes, the character rate is 18 wpm. If you have been studying at a rate different from the rate to be used in the test, you might not do as well. The code may sound unfamiliar.

Now, I realize that on-the-air QSO's with CW have many different rates, but during a test, you need everything possible going for you, and no surprises.

Imagine practicing the 13 wpm code with headphones at a normal rate of 15 wpm, but being tested with a character rate of 25 wpm, spaced to 13 wpm, on an open loudspeaker in a hollow auditorium? If that doesn't blow you away, not much will.

Also, if you've been allowed in class to go over and correct your copy after the code test, you can appreciate the surprise of not being allowed to do so at the exam test. (Remember, another way of passing the code test is to have one minute of perfect copy.) Many examiners will ask you to put down your pencil as soon as the last dit/dah/dit is sent. You have no option to go back and clean up your copy for one minute of perfect copy. But if you knew this ahead of time, you might be able to correct your copy on the run, and have a greater opportunity to pass the examination the first time through.

"There should be a specific short time allowed for an examinee to fill in his or her copy sheet before it is graded for one minute of solid copy," says Bill Wiggins N4BMR, an active ham interested in fair examinations. "If an examinee is going to pass on solid copy, it should be based on what he copied while the tape was playing, not on what might be reconstructed by studying over the copy sheet for five or 10 minutes. I would suggest one minute, but definitely not more than two minutes."

About 10 years ago, the FCC issued guidelines for the CW character rates for 5, 13, and 20 wpm:

5 wpm character rate at 15 wpm
13 wpm character rate at 15 wpm
20 wpm character rate at 21 wpm

Most training tapes and CW tests are fairly close to this. The ARRL uses 18 wpm character rates for the 5 and 13 wpm CW tests and training tapes, but it's close enough not to throw you. But if an old Navy telegrapher hand-sends the CW test, he might come up with a 25 wpm character rate for the Novice

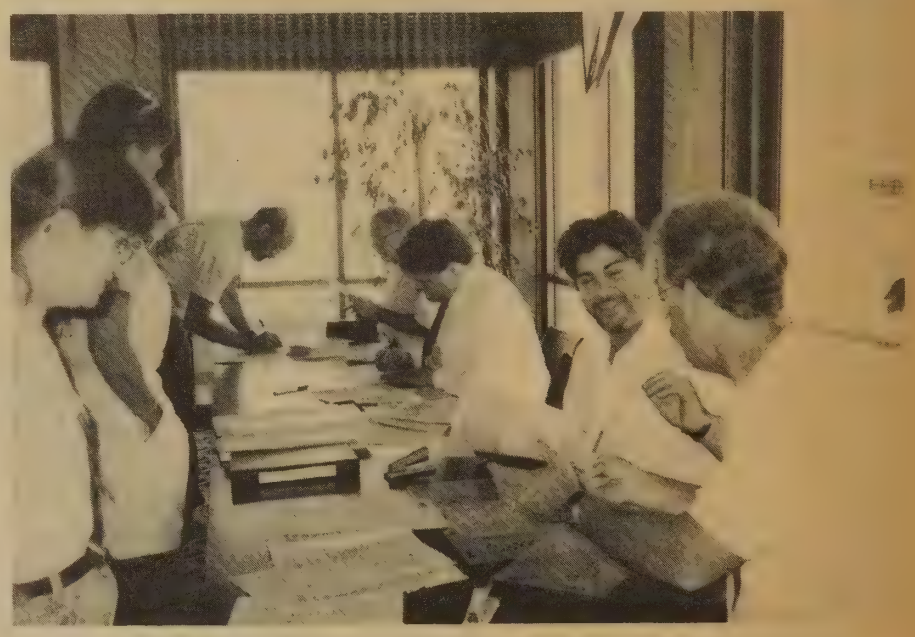

Photo A. A Southern California W5YI team corrects exams as students look on.

U.S. Volunteer Examiner Co-ordinators in the Amateur Service

Anchorage Amateur Radio Club
2628 Turnagain Parkway
Anchorage AK 99503
(907) 243-2221, 344-5401

ARRL/VEC*
225 Main Street
Newington CT 06111
(203) 666-1541

Central Alabama VEC, Inc.
606 Tremont Street
Selma AL 36701
H: (205) 872-1166, 872-5450
O: (205) 874-1688

Charlotte VEC
227 Bennett Lane
Charlotte NC 28213
(704) 596-2168

DeVry Amateur Radio Society*
3300 North Campbell Avenue
Chicago IL 60618
(312) 929-8500

Golden Empire Amateur Radio Society
P.O. Box 508
Chico CA 95927

Greater Los Angeles Amateur Radio Group
9737 Noble Avenue
Sepulveda CA 91343
(818) 892-2068

Jefferson Amateur Radio Club
P.O. Box 73665
Metairie LA 70033

Koolau Amateur Radio Club
45-529 Nakuluai Street
Kaneohe HI 96744
(808) 235-4132

Laurel Amateur Radio Club, Inc.
P.O. Box 3039
Laurel MD 20709-0039
(801) 434-6087, 572-5124

Mountain Amateur Radio Club
P.O. Box 234
Cumberland MD 21502
(304) 289-3576

PHD Amateur Radio Association, Inc.
P.O. Box 11
Liberty MO 64068
(816) 781-7313

Triad Emergency Amateur Radio Club
3504 Stonehurst Place
High Point NC 27260
(919) 841-7576

Sandarc-VEC
P.O. Box 2456
La Mesa CA 92044
(619) 465-3926

Sunnyvale VEC Amateur Radio Club
P.O. Box 60031
Sunnyvale CA 94088-0031
(408) 255-9000

The Milwaukee
Radio Amateurs Club, Inc.
1737 N. 116th St.
Wauwatosa WI 53226
(414) 774-6999

Western Carolina
Amateur Radio Society
5833 Clinton Hwy., Suite 203
Knoxville TN 37912-2545
(615) 688-7771

W5YI-VEC*
P.O. Box 565101
Dallas TX 75356-5101
(817) 461-6443

*This VEC regularly offers monthly exams in all parts of the country.

5 wpm test, leaving big spaces between each rapid fire dit and dah that will really sound strange to any new examinee.

"I have yet to see a well-prepared examinee have a problem with character speed and spacing. There are the poorly prepared who fail. The majority of these realize that they were not well-prepared, and say nothing. They go on to study and practice for their next try. Then there are the poorly prepared who fail, and blame it on the testing system rather than acknowledging to themselves and others their lack of preparation," adds Wiggins.

Other than the 5, 13, or 20 wpm overall rates, volunteer examiners are not required to standardize their CW tests. Most stay fairly close to the FCC's published guidelines, and this allows any upgrade candidate to take almost anyone's test. Reasonable sounding code, similar to home study and class practice, is produced.

Most seasoned hams agree that it is poor practice to encourage students to shop around for an easy CW exam. "Morse code tests should be sufficiently standardized in content and not deliberately be made either easier or harder to pass because of the wording content," says Wiggins. An "easy" exam would include several double-digit numbers, or maybe two or three minutes with a string of common characters like A, N, T, M, O, E, I, S, H, and other giveaways. As for making the test harder, he points out that "There should be no misspellings or illogical facts to deliberately confuse an examinee."

Most CW tests offered by volunteer examiners throughout the country are fair, close to FCC published guidelines, and contain a typical QSO with call letters at the beginning and end of the test. It has been years since I have heard of deliberate misspellings or illogical content. And it has been months since I have heard about any three-member exam teams just waiting to get a few candidates, and "bust their chops."

But do contact your VE team leader ahead of time, and find out as much information as you can about what your CW test will be like. Certainly they'll tell you about headphones or speaker, QSO or random, and whether or not the test meets the FCC published guidelines. (For a copy of the FCC amateur radio code test guidelines, send a self-addressed stamped envelope to *Radio Fun*, Forest Rd., Hancock NH 03449. ATT: Gordon West.)

Helping Out

Finally, take time to work closely with your VEs. They are a dedicated group of volunteer hams who don't earn a cent for their efforts. See what you can do to assist them during your upcoming exam. Maybe bring doughnuts? Offer to help them move the tables in and out? Offer them a free meeting location for future exams?

Congratulations to those of you who are volunteer examiners, or who are working to assist volunteer examination groups. And good luck to those of you who will soon be working with these volunteer examiners to pass your next upgrade. RF

You may contact Gordon West WB6NOA at 2414 College Dr., Costa Mesa CA 92626. FAX (714) 434-0666.

Mir Notes

U2MIR and UW3AX appeared at the Houston Ham Convention last November. In a brief *Westlink Report* article, NN5O asks: Did you know that Musa (U2MIR/UV3AM) has spent more time in space than any other human? Has had more space walks? The longest space walk (EVA—extra-vehicular activity)? Was last up with Helen Sharman, the English astronaut? Is a real contest ham, and participated in the recent Stars of the Air contest from Leningrad on the weekend of the aborted Soviet coup?

And further, did you know that Boris UW3AX is the father of the RS Soviet ham satellites, and has helped design each one? That he trains each *Mir* crew in ham radio and communications? Is a big-time contester and DXpeditioner, having participated in the Seattle World Games and operated with the veteran crew on MV Island as 4J1FS? Is Deputy Chief Editor of *Radio* magazine, the leading ham publication in the USSR? Is the father of the SOA contest?

Worldwide Gateway

Earlier this year KI6QE and NL7NC established a message gateway between Alaska and the "lower 48" states using amateur satellite AO-16. This gateway has proven to be so successful that it has now been expanded to every continent in the world. It also uses all of the PACSATs (packet satellites: AO-16, LO-19, and UO-14). There are more than 20 gateway stations providing coverage for the U.S., Europe, Asia, Oceania, South America, the Carribean, South Africa, the Middle East, and even the Arctic Circle (Baffin Island). These stations have become so proficient at moving NTS and personal message traffic that it is now common for them to deliver all of their messages within 24 hours of receipt from the originating station. Recently, they have even been able to turn around the "end-to-end" responses to these messages in less than 24 hours. KI6QE points out that this quick response could greatly facilitate the movement of emergency and health-and-welfare traffic after a major natural disaster.

Although successful in automating the receipt of message traffic and preparing it for upload to the PACSATs, KI6QE says there is more work to be done in moving the traffic out after it gets to the destination gateway stations.

KI6QE would like to encourage all radio amateurs to use this service provided by the 20 gateway stations around the world. This highly skilled group of OSCAR satellite enthusiasts come from all walks of life, and are dedicated to providing this service to the amateur community worldwide. Contact KI6QE @ AA6QD.#CENCA.CA. or via AO-16, LO-19, or UO-14. TNX *The Nashua Area Radio Club Bulletin, Vol. 15, No. 11.*

what next?

by Carole Perry WB2MGP

Ham Radio—The Ageless Hobby

One of the best things about being involved in amateur radio is the ability and opportunity to meet all kinds of different people. The amateur radio community has within its ranks a rich pool of people representing varied and exciting occupations, backgrounds, cultures, abilities and interests. Being a "people person" myself, I've always most enjoyed having the chance to get acquainted with the myriad of hams to be met on the air, or at local hamfests and national ham conventions. I am always pleasantly surprised to note the wide range of age groups represented in the hobby.

Recently, I had occasion to speak with two very interesting hams. One was Neil Rapp WB9VPG, who had the distinction of being the youngest ham for a number of years; the other was Gertrude Reed, callsign 1OG, who was 96 years young on July 5th. The fun of meeting up with both of these super people within weeks of each other prompted me to dedicate this month's column to them.

Pretty Stunning

Neil told me how, years ago, his dad Delbert found a straight key and an oscillator one day in a box of old junk a friend had given him. His dad had been interested in becoming a ham when he was in high school, but he had never pursued it. Suddenly having a key prompted him to respond to an ad from the local ham club, the Old Post ARS, for a Novice class at Vicennes University.

When Delbert arrived at the class, a 13-year-old girl was there learning the code. This gave him the idea of bringing Neil to the class even though Neil was only 5 years old. Amazingly, Neil caught on quickly and soon passed the Novice exam. The instructors were so stunned that they had every person in the class sign his code test to verify that Neil had indeed passed. He received his license on July 17, 1976; by then, Dad had become WB9UKG. At the time, Neil was the youngest person in the world to become a ham.

Neil also set the record for being the youngest ham to upgrade to each class of license. After a few tries, Neil upgraded to Tech in 1977 at the ripe old age of 6, and to General in 1978 at age 7, and then to Advanced in 1979 at age 9.

It was just a matter of time before his mom, Margie, became curious about what Neil and Delbert were sending to each other in code. So in 1977 Margie became WD9HEE. Both Neil and Margie have fun memories of those early days in their ham careers. For example, they both laugh at the fact that Neil wasn't able to sign his name on the 610 license form. He had to learn to sign his name in script in the signature box before his application would be accepted.

In 1990, Neil became an Extra class. He soon became an accredited VE with the ARRL and W5YI. Neil reactivated the radio club at the University of Southern Indiana, which he currently attends. As president of the club, he is working on replacing all the equipment that was damaged from improper storage over the years.

Neil has expressed concern that there aren't enough scholarships for young people in ham radio who go on to pursue careers in fields other than engineering. He stresses the point that one of the nice things about ham radio is the diversity of the people in it. Having experts in many different fields can only enrich and advance the hobby.

A Double Accomplishment

For years I've been stressing to the young ladies in my classes the importance of not being intimidated by technical subjects or male-dominated fields of study. As a matter of statistics, the girls do just as well as the boys when it comes to the license exam.

One young lady who certainly didn't let any stereotypes or prejudices stand in her way was Gertrude Tarr Reed. What a fascinating lady to speak with! As Gertrude recalled her ham radio experiences as a young girl, she took me on a verbal tour of a bygone era. Gertrude is a veritable storehouse of memories of a time in America most of us can only read about in a book. She is one of the most delightful people I have had the privilege to meet in amateur radio.

Gertrude was an inquisitive teen-aged girl who became interested in her brother's science books in 1912 when she was a junior in high school in Rockport, Massachussettes. She and her good friend Margaret Campbell decided it would be fun to build a radio themselves. Their first attempt was unsuccessful, but they didn't give up. The second radio they built allowed them to pick up signals from the Wellfleet station. The messages were sent in code, so the girls copied down everything they could. Gertrude and Margaret found they were getting proficient at copying code, so they decided to pick up speed and try for their radio licenses.

The girls' families were concerned about them traveling to Boston alone, but Gertrude recalled that the trip was made without any problems. They were given their exams by a man "with so much gold braid I thought he must be an Admiral," Gertrude said. He placed the girls on opposite sides of the room and tested them on the code, going faster and faster until they were up to speed. I could almost hear a smile in Gertrude's voice as she described how the examiner left the room for about 20 minutes, and returned with the news that they were the first two females in the United States to get ham radio licenses.

Gertrude and Margaret then made their way over to the Custom House in Boston to be assigned their call letters. Gertrude recalls that her call sign was 1OG, but she couldn't remember Margaret's. Margaret Campbell has since passed away.

Photo A. An extraordinary ham: Neil Rapp WB9VPG passed his Novice code and theory when he was five years old. At six, he upgraded to Tech; at seven, to General. By the age of nine, Neil had an Advanced class license.

Off to Work

In 1913 Gertrude was graduated among the 13 members of the class at Rockport High School. In addition to her radio hobby, Gertrude loved playing baseball and other games with her four brothers. Even though athletics were not considered very feminine at the time, she considered enrolling in the physical education school, but changed her mind and instead took a course for nine months at the Boston School of Telegraphy.

For her first job, she worked for two years at the postal telegraph in Boston. She and one other woman worked with 98 men in the office. Next, she worked for two years at the Gloucester telegraph office. Then Western Union offered her a job. This job required her to learn the International Morse Code. To get her ham radio license, Gertrude had learned the continental code.

As part of her job, Gertrude got to meet several famous people. Gertrude recalled the time a chauffeur came in to send a message at the Manchester Western Union office, and a man walked in and handed him a piece of paper. That man turned out to be President Woodrow Wilson, who then shook Gertrude's hand.

She also remembers going on an assignment to Franklin Delano Roosevelt's first campaign rally, and getting introduced to him.

Gertrude and Margaret were always excited when Robert E. Evans, Admiral of the North Fleet, would call them to say hello. One day they got to meet with him in person. The young ladies were obviously something of a novelty in those days.

In 1923 Gertrude married Ed Reed and they had one son. Today she has three grandchildren and four great grandchildren. During the summer she watches nearly every Red Sox game. In the winter she follows the Celtics, the Bruins, and the Patriots. She was eager for me to report that she's already seen three Red Sox games in person this year. She no longer has a radio in her home, but she is a proud member of the Old Old Timers Radio Club, which won't accept members under the age of 75. Barry Goldwater is a fellow club member. Gertrude Tarr Reed also belongs to the Cape Ann Radio Club, the Sandy Bay Historical Society, the Martha Washington Chapter of the Eastern Star, and the American Legion Auxiliary. This is quite a lady!

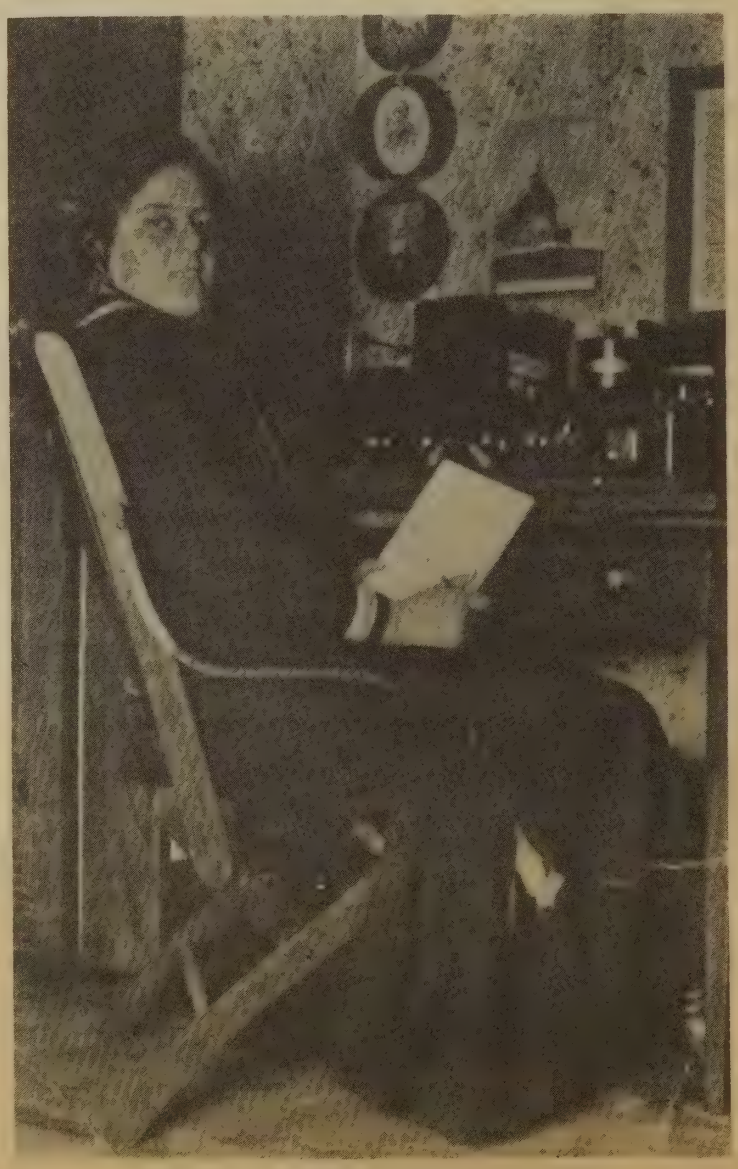

Photo B. Gertrude Tarr, callsign 1OG, in 1912. The second radio she and her friend Maragaret built worked. They learned code by copying signals over the air.

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences, along with photos, to Carole Perry at Media Mentors, Inc., P.O. Box 131646, Staten Island NY 10313-0006.

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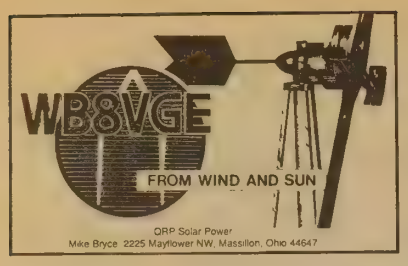

radio magic

by Michael Bryce WB8VGE

A Dead Radio is a Dead Radio

For some people, ham radio is communicating with friends they'll never meet. To others, it's the fast and competitive pace of a contest. To me, it's the quiet time spend on the bench fixing a broken radio. Believe me, sometimes the dead radio is a real radio mystery!

Although it may sound funny, a completely dead radio is probably the easiest kind to fix. A dead radio is just that—dead! No dial lights, no sound, no static: *nothing*. A radio with these symptoms has a problem in one area for sure: the power supply.

But alas, a hidden problem may have caused the power supply to shut down in the first place. If you replace a fuse in the power supply and it blows again, you know you have problems down the line.

Using Your Eyes—and Nose

Before you unfold the radio's schematic all over your work bench, take some time to look the radio over. Do you smell any strange odors coming from it? The smell of burnt resistors really sticks out. Likewise with the transformers and chokes. The varnish smells really bad when it gets hot and starts to burn.

Scan the circuit boards for obvious signs of overheating. If the PC boards are made of cheap paper material, they will have turned a very dark brown. If some of the parts got hotter than they should have, they'll burn the PC board. This is especially true of power supplies. Look over these areas carefully.

Resistors that overheat are easy to spot. They bulge out at the center, and some of the paint used for the color codes may have burned off. Don't replace any of these resistors just yet. We should find out what made them overheat in the first place.

Capacitors

Capacitors showing any type of deposits on them should be suspect right off the bat. This is especially true for the paper and wax capacitors used in the older radios. You won't find these in a modern transceiver. Electrolytic capacitors with ooze coming out of their sides (or bottoms) means a bad capacitor without question.

While we're on the subject of capacitors, I've found you can't trust the smaller tantalum capacitors used in today's radios. They either become leaky or they short out altogether. Keep your eyes open for these critters. I have found one or two shorted out in many a dead power supply.

The caps are commonly used to bypass the Vcc line (the line supplying the collector) on ICs. If the capacitor is leaky or shorted, the entire Vcc line is shorted! Finding this culprit can be a real time consumer.

In real life, the loose wire fix only works in the movies. I've never been lucky enough to fix a radio by the loose wire method. But you could try wiggling the wires a bit, just in case you're really living a good life. You never can tell.

Checking the Obvious

Of course, check over the entire radio for obvious signs of trouble. Check for tubes loose in their sockets. Are there any obvious signs of physical damage? Broken IF transformers or coils will make for an easy fix, provided you can get the parts.

Sometimes a nonfunctioning radio is the fault of an improperly set control. If you have the VFO selector set for an external VFO, but the external VFO isn't connected, the radio will not operate.

Check for a "lock" switch being on. This will cause the radio to appear to be dead, only to perk right up when the proper switch is thrown. A VFO appearing not to work can sometimes be traced to the VFO LOCK switch being on.

After you have done all of the above, and still can't seem to get any life out of the radio, it's time to dig a bit deeper. You'll need some basic electronic tools for this.

At the Work Bench

Now, since I don't have access to Bill Orr's lab (W6SAI), I have to use the tools and test gear I can afford. For you and me, we don't need the most accurate test gear in the world. We're not launching missiles here, so we can afford to be off a bit.

With today's modern solid state radios, a good autoranging digital VOM (volt-ohm-meter) would be first on my list for test gear. With the digital VOM, you don't have to worry about getting the probes reversed. The autoranging feature will keep you from flipping knobs or pushing buttons while you're busy inside the guts of the radio. You should be able to pick up a good autoranging VOM for under $50.

Check Radio Shack or some of the advertisers here in *Radio Fun* for a good VOM. Don't spend too much money for features you don't need, like a built-in capacitor or transistor checker. Most digital VOMs have an input impedance of at least 11 megohms. This prevents the meter from loading

Continued on page 28

Work DX Without Six Elements

Have fun with a dipole.

by Joseph E. Taylor K5PAC

Obviously, you won't work as many, or as often, as the fellow on top of Crow Mountain with a six-element beam, a 100-foot tower, and a 2 kW rig—but you can work a surprising amount of DX of all sorts with Q5 QSOs if you go at it right.

Many hams do not venture into the DX portions of the bands because they feel that they are not well enough equipped to work any DX. It's not necessarily so!

So you operate with low power and no beam, and little chance of improving either—you can still work DX and enjoy it.

What Does DX Mean to You?

Maybe we ought to ask, "What is DX?" since not everyone means the same thing by that term.

Old Charlie on the mountain has nearly 300 countries confirmed now. To him, DX is another new country. "So what's another 3D6 if you already have cards from each one that counts?"

But to most of us, DX is that unique satisfaction associated with calling a fellow ham in another country, whether 3,000 or 10,000 miles around the globe, and hearing him come back with that sweet sound that is our own personal, private call! And the thrill is apt to be all the greater if we are operating with what we know to be less than the ultimate in equipment. A VQ9 on a beam or a quad is satisfying, to be sure, but on a dipole there is an added dimension to the enjoyment.

By this I am not advocating that you use anything less than the best combination of equipment and antenna you can muster. The 6-element beam is wonderful if you can swing it, but my point is, you aren't out of the running if you can't.

A word needs to be said about what is meant by "working" DX, too. For some fellows, it means an exchange of RST, QTH, and 73s. For others it involves a greater degree of getting acquainted as person with person. Where you find your satisfaction is up to you.

Admittedly, it's harder to maintain a DX contact than it is to get one. So your percentages go down as your time in QSO goes up. In effect, each of us works out his own pattern here.

CW or phone? Again, we have to look at plain facts. Your chances with lower power and/or simpler antenna systems are better on CW than on phone. A good receiver can dig out and render copyable an extremely weak CW signal that would be hopelessly buried on SSB.

So, if you can do so enjoyably, you will have improved chances of success in CW operating. Don't be overly worried if your CW isn't perfect and your speed is down. DX operators are among the world's best at matching speeds. You will find fast ones and slow ones, and very nearly all of them are patient, so don't chicken out on this score.

Suggestions for Good Operating

1. Check your rig thoroughly. The fact that your power is limited doesn't mean your efficiency needs to be.

2. Go over your receiver with the same kind of thoroughness. More contacts are lost because of inadequacy in receivers than in transmitters.

3. Give your antenna system a chance to do its best. Make sure it is the best you can arrenge for a given DX band. If the system is not rotatable, try to orient it toward your favored direction. For example, in the central United States a dipole oriented NW/SE will favor both Europe and Australia. The direction of a dipole won't matter tremendously, but take whatever advantage you can get. Remember, too, that the longer your wire, the better, assuming that it and the line are tuned.

4. Listen—listen—listen. Spend hours on the bands you are interested in, just listening. See what bands are open, when, and to what parts of the world. Find out what parts of the DX bands will be best for you. For instance, you may find less crowding around 28.470 than around 28.325. For a signal which has its limitations, you may do better there even though you hear more DX on the lower frequency.

5. When a DX station is calling CQ, be ready to call back the instant he signs. If you drag your feet, another station will probably answer his call first, and that may be your only chance. Assume others will answer at once, too.

Don't call too long. After repeating his call once and your own call twice, break to see if he heard you. If he isn't answering, try two more of each. This is much better than four repetitions to begin with.

6. Calling CQ DX: Don't be afraid to do it, but don't overdo it, either. Remember, your signal needs an opening more than it needs repetition. Try to find a little gap between signals. Call QRZ once and sign your call. If there is no response, call CQ DX once and your call twice and K. No more.

No fancy stuff. No AR-K, DX pse KKK. In general, the DX boys are good operators, and they will respond to good practice on your part.

7. Answering: When you get a response, keep your first transmission very short. Perhaps something like "XY9AA de K5PAC R - GM OM ES TKS CALL UR RST 559 - 559 QTH LITTLE ROCK AR - NAME JOE - HW - XY9AA de K5PAC - K.

There is little point in repeating what he got the first time, so unless his signal is very weak, keep your repetitions to a minimum. He will want his report, your QTH, and your name. The rest can come in later transmissions. Get your first round completed, then get acquainted if conditions permit and if he wants to. If he wants a short QSO, fine, keep it short. Your last transmission can be friendly without wishing "73s, 88s, gud luck, best DX, and gud health" to each member of his family individually.

8. QSLing: If either of you really wants a QSL, be prompt about it. If not, "pse QSL" is not an essential part of a QSO. He won't have his feelings hurt if you don't ask him for one. If you actually want it, OK. If not, why put him to the trouble and expense?

This article was written to convince you that you can have fun in the DX aspect of the hobby even without kilowatts and beams. This is not speculation or theory. In the past we've had quads and beams, and I thoroughly believe in them. But in our present QTH the very best I could come up with was a 100-foot-long dipole fed with open line into a home-brew tuner. The rig runs about 180 watts CW.

Frankly, I've had a ball working DX on 15 and 20 meter CW. Why not crank up your rig and join me? RF

Reprinted from the May 1969 issue of 73 Magazine. *Joseph E. Taylor K5PAC, 1901 Willard, Springdale AR 72762.*

Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested.

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radio magic

Continued frompage 26

down the circuits. Don't buy a cheap digital (or analog) meter with an input impedance of 20k or less ohms.

Another good piece of gear I find very valuable is the analog vacuum-tube-volt-meter, or VTVM. This is a rather old piece of test gear by today's standards. Its high input impedance (11 megohm) won't load down the circuits. It's great way to check a moving voltage level, which is hard to do with a digital voltmeter. You can't really get a good reading on a digital voltmeter when you have to peak a coil for maximum voltage. Even a newer digital voltmeter with a built-in bar graph is not as handy as a good old fashioned VTVM.

Next month we'll look at some other test gear for the shack and the basics for simple troubleshooting. RF

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Uncle Wayne's Bookshelf

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20N101 **Everyday Electronics Data Book** ***by Mike Tooley BA.*** Information is presented in the form of a basic electronic recipe book with numerous examples showing how theory can be put into practice using a range of commonly available 'industry standard' components and devices. 256 pp. 134 line drawings. **$18.00**

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RF0192

Who Is the Youngest Ham?

It's getting more and more difficult to determine the youngest amateurs in the country by classification. Now we hear of nine-year-old Reuben Schuff KB9EGP who went into a DeVry sponsored exam as a Technician and passed the General, the Advanced, Extra code and theory tests at one sitting! TNX *B-N-T, Vol. 19, Issue 11.*

A First DXpedition

Continued from page 18

One of our goals was to work Masa JA1DM, who had written us that St. Paul was one of the three remaining countries he needed for the DXCC honor roll. Day after day, propagation remained poor, and Asia silent. Probably the only reason we did fairly well in Western Europe and North America was our excellent antenna location. At 13:00 UTC on what was to be our last morning, we tied the beam tether to the "330 degree stake" and worked a few faint JAs. Alas, no Masa.

However, Nature took a hand. The sea was getting so rough that the Morrison's fishing boat couldn't get us off, so we left the stations assembled and tried again for contacts at 13:00 UTC the next morning. Weak and noisy, but VKs and JAs! On a whim, we swung the TA-33 around to about 360 degree and—stronger signals. We crowded around as Jan asked the first strong JA station he worked if he knew JA1DM. Toshi JA1ELY said he did and would telephone Masa. A minute later, to our delight, JA1DM came on and we made the contact!

Thursday morning was sunny and calm as we watched Jackie Morrison's boat approach. After loading the dory we said good-bye to Arnold and Wally (I think they were quite entertained by our loony activities) and were rowed back to the *Elizabeth Ryan*. Incidentally, there's no feeling quite like seeing your only transceiver delicately balanced on the gunwale of a heaving dory prior to being pitched up onto the deck. The trip back was beautiful and we were escorted by some humpback whales. A boat tour of the Cape North-St. Paul-Dingwall area run by Nelson Morrison, "Aspy Bay Tours," should be part of any trip to Cape Breton.

Lessons Learned

Here are some of the things we learned about pile-ups and DXpeditioning:

1) Careful planning, months in advance, is an absolute must for a smooth successful expedition.

2) Operating simplex by call areas works fairly well in North America, but split operation is necessary for big European pile-ups.

3) If someone puts you on the DX packet-cluster it really brings 'em out of the woodwork in that region.

4) Announce periodically to a pile-up the *other* bands the expedition is currently on. We probably missed a lot of contacts by not doing this sooner.

5) Prearranged operating skeds aren't very useful if propagation is poor or changing. Constant checking and calling is necessary.

6) We should have selected operating frequencies to allow U.S. General licensees to work us (21.305, not 21.295; 7230, not 7205; etc.). Sorry, guys!

7) While a beam, tower, and linear meant much more gas, weight, and stuff to haul over the rocks, they really enhanced our effectiveness.

8) In a big pile-up, set rules and don't reward the rule breakers with a contact. In our case, a few stations received the dread phrase, "(miscreant's callsign), you are *not* in the log!"

Our final tally was 5,500 contacts in 105 countries, 84% phone and 16% CW. Not impressive by today's standards but, outside of some craziness in the biggest pile-ups, we sure had fun doing it!

RF

We sincerely thank the West Island Amateur Radio Club, our sponsors; W5KNE (for the write up in his "DX" column, 73 Amateur Radio Today, *August 1991, page 58); our families; the Coast Guard; and Nelson, Jackie, Arnold and Wally for helping make it a great trip! Please address queries, comments, and extravagant donations to us and all QSLs to the club call, VE2CWI.*

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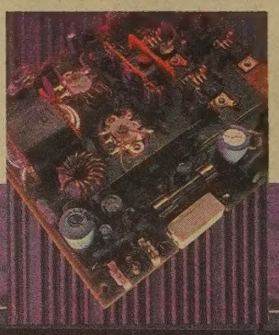
Specifications subject to change without notice.
Specifications guaranteed only within amateur bands.

One-Year Limited Warranty on all Amateur Radio Products

EXAMINE THE IC-725 PIECE BY PIECE



PA UNIT
provides 100%
duty cycle

CPU UNIT
contains
band
stacking
registers

DDS UNIT
provides excellent
signal-to-noise ratio

From the CPU to the DDS System to the final output board, the ICOM IC-725 is designed for you . . . the amateur who demands relentless performance.

Whether its fixed, mobile or portable operation you desire, the IC-725 will open your eyes to what amateur radio should be. World renowned for excellence in circuit design, versatility and dependability, the IC-725 is backed by a full one-year factory warranty.

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All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 725791
For a brochure on this or any other ICOM product, call our Toll-Free Literature Request Hotline 1-800-999-9877.

CIRCLE 179 ON READER SERVICE CARD